YAMATAKE

No. CP-UM-1586E

DigitroniK Line
SDC30/31
Digital Indicating Controller

User's Manual

Thank you for purchasing the SDC30/31. This manual contains information for ensuring correct use of the SDC30/31. It also provides necessary information for installation, maintenance, and troubleshooting.
This manual should be read by those who design and maintain devices that use the SDC30/31.
Be sure to keep this manual near by for handy reference.

Yamatake Corporation

RESTRICTIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment. Accordingly, when used in the applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human safety may be put at risk.

REQUEST

Ensure that this User's Manual is handed over to the user before the product is used.

Copying or duplicating this User's Manual in part or in whole is forbidden. The information and specifications in this User's Manual are subject to change without notice.

Considerable effort has been made to ensure that this User's Manual is free from inaccuracies and omissions.
If you should find any inaccuracies or omissions, please contact Yamatake Corporation.

In no event is Yamatake Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

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Safety Precautions

■ About Icons

Safety precautions are for ensuring safe and correct use of this product, and for preventing injury to the operator and other people or damage to property. You must observe these safety precautions. The safety precautions described in this manual are indicated by various icons.

As the following describes the icons and their meanings, be sure to read and understand the descriptions before reading this manual:

⚠ WARNING

Warnings are indicated when mishandling this product might result in death or serious injury to the user.

⚠ CAUTION

Cautions are indicated when mishandling this product might result in minor injury to the user, or only physical damage to this product.

■ Examples

	Triangles warn the user of a possible danger that may be caused by wrongful operation or misuse of this product. These icons graphically represent the actual danger. (The example on the left warns the user of the danger of electrical shock.)
	White circles with diagonal bar notify the user that specific actions are prohibited to prevent possible danger. These icons graphically represent the actual prohibited action. (The example on the left notify the user that disassembly is prohibited.)
	Black filled-in circles instruct the user to carry out a specific obligatory action to prevent possible danger. These icons graphically represent the actual action to be carried out. (The example on the left instructs the user to remove the plug from the outlet.)

⚠ WARNING

	Earth the FG terminal with a ground resistance of maximum 100 Ω before connecting to the measurement target and external control circuits. Failure to do so might cause electric shock or fire.
	Before wiring, or removing/mounting the SDC30/31, be sure to turn the power OFF. Failure to do so might cause electric shock.
	Do not touch electrically charged parts such as the power terminals. Doing so might cause electric shock.
	Do not disassemble the SDC30/31. Doing so might cause electric shock or faulty operation.

⚠ CAUTION

	Use the SDC30/31 within the operating ranges recommended in the specifications (temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc.). Failure to do so might cause fire or faulty operation.
	Do not block ventilation holes. Doing so might cause fire or faulty operation.
	Wire the SDC30/31 properly according to predetermined standards. Also wire the SDC30/31 using specified power leads according to recognized installation methods. Failure to do so might cause electric shock, fire or faulty operation.
	Do not allow lead clippings, chips or water to enter this controller case. Failure to do so might cause fire or faulty operation.
	Inputs to the current input terminals ⑥ and ⑧ on the SDC30/31 should be within the current and voltage ranges listed in the specifications. Failure to do so might cause electric shock or faulty operation.
	Firmly tighten the terminal screws at the torque listed in the specifications. Insufficient tightening of terminal screws might cause electric shock or fire.
	Do not use unused terminals on the SDC30/31 as relay terminals. Doing so might cause electric shock, fire or faulty operation.
	We recommend attaching the terminal cover (sold separately) after wiring the SDC30/31. Failure to do so might cause electric shock.

⚠ CAUTION

Use the relays on the SDC30/31 within the service life listed in the specifications.
Continued use of the relays after the recommended service life might cause fire or faulty operation.

Use Yamatake Corporation's SurgeNon if there is the risk of power surges caused by lightning.
Failure to do might cause fire or faulty operation.

HANDLING PRECAUTIONS

After turning the power ON, do not operate the SDC30/31 for at most 7 seconds to allow the SDC30/31 to stabilize.

SAFETY REQUIREMENTS

To reduce risk of electrical shock which could cause personal injury, follow all safety notices in this documentation.

This symbol warns the user of a potential shock hazard where hazardous live voltages may be accessible.

* If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment must be impaired.
* Do not replace any component (or part) not explicitly specified as replaceable by your supplier.
* All wiring must be in accordance with local norms and carried out by authorized experienced personnel.
* The ground terminal must be connected before any other wiring (and disconnect last).
* A switch in the main supply is required near the equipment.
* In case of AC power supply models, mains power supply wiring requires a (T) 0.5 A, 250 V fuse(s). (IEC127)

EQUIPMENT RATINGS

Supply voltage	100 to 240V ac (operating power voltage 85 to 264V ac)
Frequency	50/60 Hz
Power or current ratings	18 VA maximum

EQUIPMENT CONDITIONS

Do not operate the instrument in the presence of flammable liquids or vapors. Operation of any electrical instrument in such an environment constitutes a safety hazard.

Temperature	0 to 50°C
Humidity	10 to 90%RH
Vibration	2 m/s^2 (10 to 60 Hz)
Installation category	Category II (IEC664-1, EN61010-1)
Pollution degree	2

EQUIPMENT INSTALLATION

- The controller must be mounted into a panel to limit operator access to the rear terminals.
- Specification of common mode voltage: The common mode voltages of all I/O except for main supply and relay outputs are less than 30V rms, 42.4V peak and 60V dc.

APPLICABLE STANDARDS

EN61010-1, EN50081-2, EN50082-2, EN61326

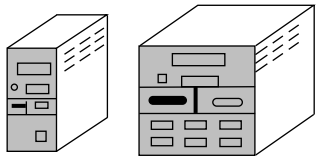
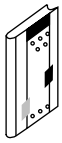
Unpacking

Check the following when removing the SDC30/31 from its package.

1. Check the model No. to make sure that you have received the product that you ordered.
2. Check the SDC30/31 for any apparent physical damage.
3. Check the contents of the package against the Package List to make sure that all accessories are included in the package.

HANDLING PRECAUTIONS

- After unpacking, handle the SDC30/31 and its accessories taking care to prevent damage or loss of parts.
- If an inconsistency is found or the package contents are not in order, immediately contact your dealer.

Name	Model No.	Q'ty	Remarks
Body 		1	See 8-1 Model Number Configuration
Mounting bracket	81405411-001	1	2 per set
User's Manual 	CP-UM-1586E	1	This manual
Engineering unit seal	N3132	1	

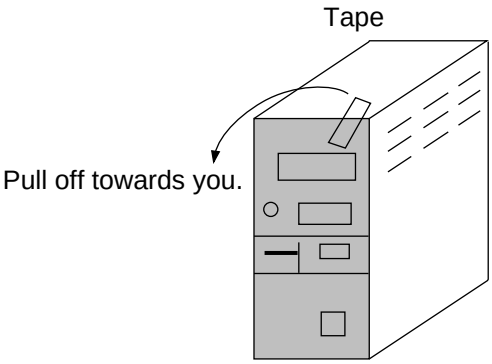
Request

The filter on the front of this controller is covered with a protective film to protect the surface of this controller.

When you have finished mounting and wiring this controller, fix cellophane adhesive tape on the corners of the filter, and pull in the direction of the arrow to peel off the protective film.

! HANDLING PRECAUTIONS

Peeling off the protective film with your fingernail might scratch the surface of this controller.



The Role of This Manual

This manual provides an overview of the SDC30/31, and describes mounting onto control panels, wiring, operation methods, troubleshooting and specifications.

The following manuals are provided with the SDC30/31.

Digital Indicating Controller SDC30/31 User's Manual

Manual No. CP-UM-1586E

This manual is provided with this controller body.

DigitroniK CPL Communications User's Manual

Manual No. CP-UM-1589E

This manual describes how to use the communication functions of this controller.

Organization of This User's Manual

This manual is organized as follows.

Chapter 1 NAMES & FUNCTIONS OF PARTS

This chapter describes the names and functions of parts.

Chapter 2 MOUNTING

This chapter describes how to mount the SDC30/31 on control panels.

Chapter 3 WIRING

This chapter describes the layout of terminals on this controller, I/O circuits, connector cables and precautions when wiring the SDC30/31 to a control system.

Chapter 4 SETTING THE SETUP ITEMS

This chapter describes how to fit this controller into instruments for use, and how to set defaults.

Chapter 5 SETTING UP THE PARAMETERS

This chapter describes how to set the constants required for operating this controller.

Chapter 6 OPERATION

This chapter describes frequently carried out operations after this controller has been fitted into instruments.

Chapter 7 TROUBLESHOOTING

This chapter describes how to remedy trouble when, for instance, an alarm is displayed on this controller.

Chapter 8 SPECIFICATIONS

This chapter describes how model Nos. are configured and the specifications of the SDC30/31.

Chapter 9 MAINTENANCE

This chapter describes the maintenance to be carried out on this controller.

For details on model No. configuration, see Chapter 8 Specifications, on page 8-1.

Conventions Used in This Manual

The following conventions are used in this manual.

! HANDLING PRECAUTIONS : Handling Precautions indicate items that the user should pay attention to when handling the SDC30/31.

NOTE : Notes indicate useful information that the user might benefit by knowing.

Check items : Check items indicate items operation precautions or items that must be checked during operation.

Index by Purpose

● **How to Use This Manual**

When using this manual, read the required item according to your specific requirements.

● Specific Requirement	● Go to These Chapters
◗ If you want to design and produce control panels	p.2-1 ..... Chapter 2 MOUNTING
◗ If you want to mount and wire this controller	p.3-1 ..... Chapter 3 WIRING p.8-1 ..... Chapter 8 SPECIFICATIONS
◗ If you want to learn about model No. configurations and specifications	p.8-1 ..... Chapter 8 SPECIFICATIONS
◗ If you want to set up defaults before operation	
Setting setup items	p.4-1 ..... Chapter 4 SETTING THE SETUP ITEMS
Setting up parameters	p.5-1 ..... Chapter 5 SETTING UP PARAMETERS
Storing parameters to PARA keys	p.5-1 ..... Chapter 5 SETTING UP PARAMETERS
◗ If you want to learn more about operations Chapter 6 describes operation in detail.	p.6-1 ..... Chapter 6 OPERATION
◗ If you want to remedy trouble	
When an alarm is displayed Learning about the meanings of alarm codes	p.7-1 ..... Chapter 7 TROUBLE SHOOTING
◗ If you want to carry out maintenance on this controller	p.9-1 ..... Chapter 9 MAINTENANCE

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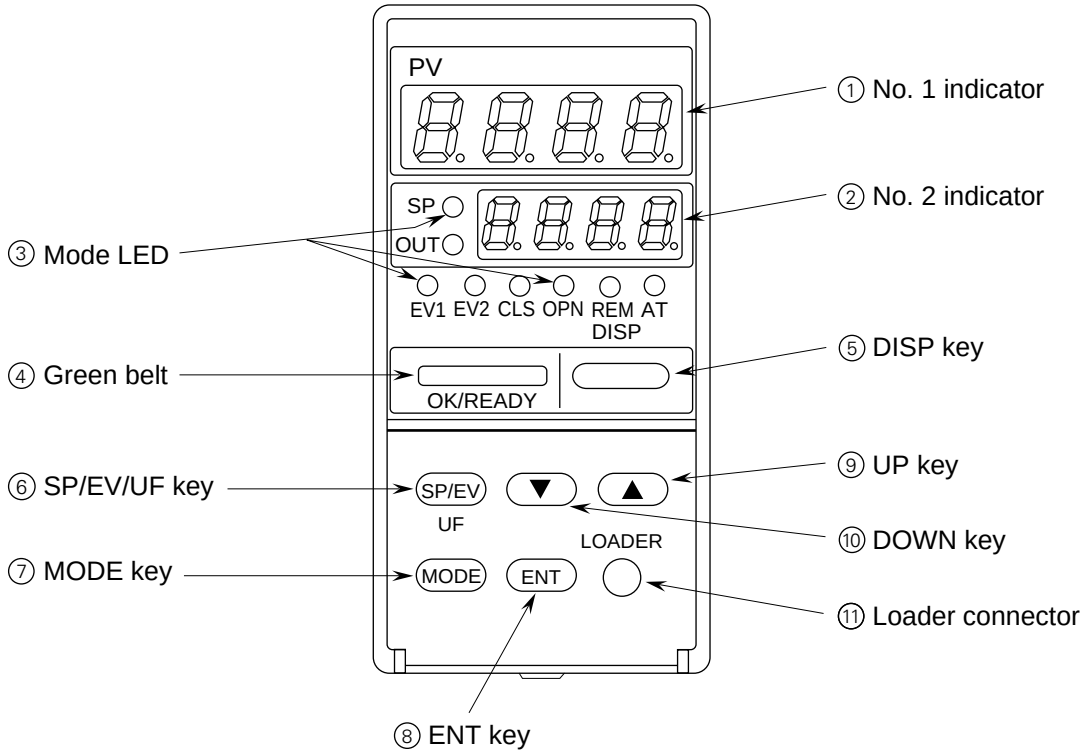
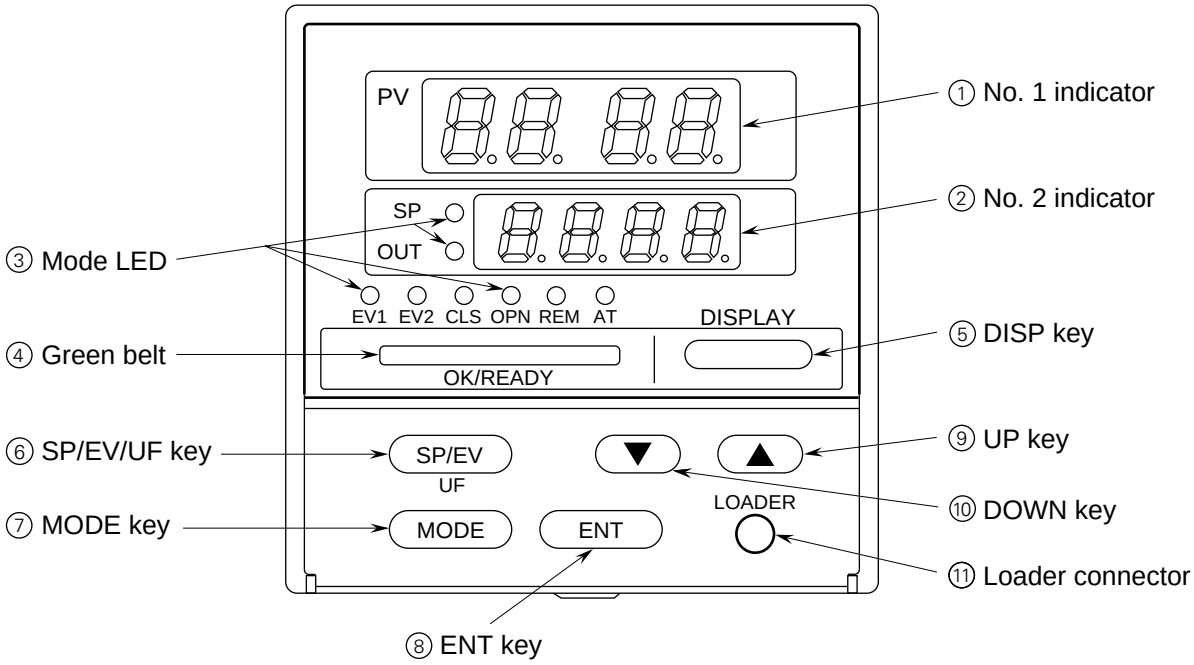
Chapter 1 NAMES AND FUNCTIONS OF COMPONENT PARTS

SDC30 (48 mm x 96 mm size)



① No.1 indicator:	Indicates a PV(Process Variable) and can also indicate the contents of parameters, etc.
② No.2 indicator:	Indicates an SP (Set Point) and can also indicate the numerics of parameters, etc.
③ Model LED	
SP/OUT:	Indicates what is expressed in the No.2 indicator .
SP lit:	Indicates the SP.
OUT lit:	Indicates the MV (manipulated variable).
SP/OUT out:	Indicates the motor valve opening.
	Or, indicates “SP ramp in operation” or “MANUAL mode.”
SP flashes:	Indicates that SP ramp is in operation.
OUT flashes:	Indicates that the current mode is the MANUAL mode.
EV1 to EV2:	Lights when an event output is turned on.
CLS (2G only):	Lights when closed direction relay is ON.
OPN (2G only):	Lights when open direction relay is ON.
OT (other than 2G):	Lights when the relay output (0D) relay is ON, and goes out when the relay is OFF.
Voltage output (6D)	Flashes according to output duty.
Current output (5G)	Lights normally.

SDC31 (96 mm x 96 mm size)



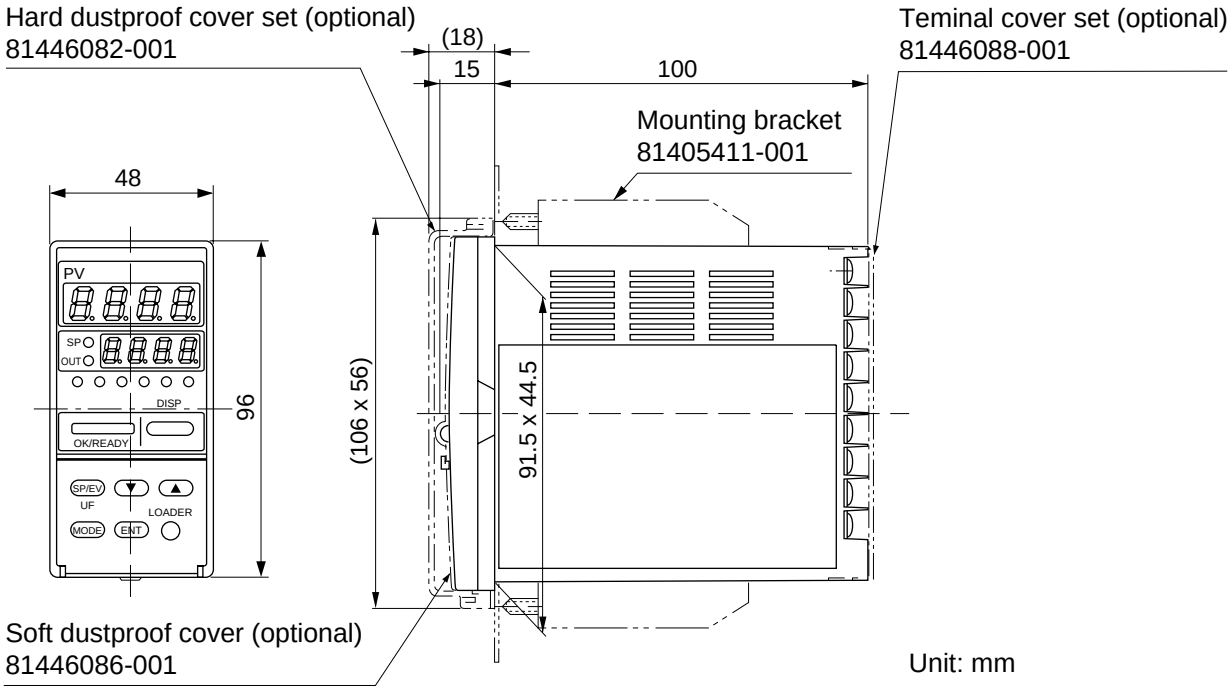
REM:	Lights when remote setting input (RSP) is selected.
AT:	Flashes during auto tuning operation. Lights during overshoot suppression learning.
④ Green belt:	Lights when a difference (deviation) between PV (Process Variable) and SP (Set Point) is within a range preset in setup item C43. Flashes in the READY mode.
⑤ DISP key:	Set the display to basic indication status. Indicates a PV on the No.1 indicator and an SP on the No.2 indicator. Determines the contents of the No.2 indicator.
⑥ SP/EV/UF key:	Selects the state by which SP, event and parameter settings registered to this key can be substituted.
⑦ MODE key:	Selects auto-tuning start/stop, AUTO/MANUAL, RUN/READY and LSP/RSP mode change items.
⑧ ENT key:	Defined a changed numeric. Sets items such as displayed parameters to a substitute (change) state.
⑨ UP (▲) key:	Increments numerics. Successively switches items such as displayed parameters.
⑩ Down (▼) key:	Decrements numerics. Successively switches items such as displayed parameters.
⑪ Loader connector:	This connector is used to connect the Handy Loader (optional).

! HANDLING PRECAUTIONS

Do not operate the console keys using a sharp-pointed object such as a propelling pencil or needle. Doing so might damage the console.

Chapter 2 INSTALLATION

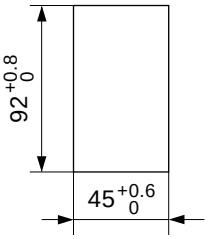
2-1 SDC30 External Dimensions



Unit: mm

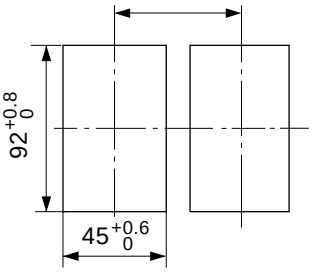
2-2 SDC30 Panel Cutout Sizes

Panel cutout size

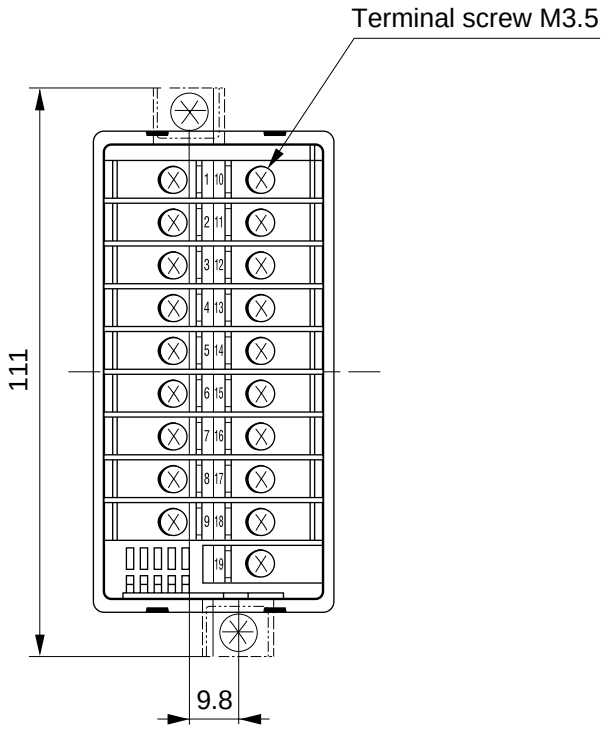


Panel cutout size (Recommended)
with vertical and horizontal mounting

52 min. (59 min. with the hard dustproof cover)



Unit: mm

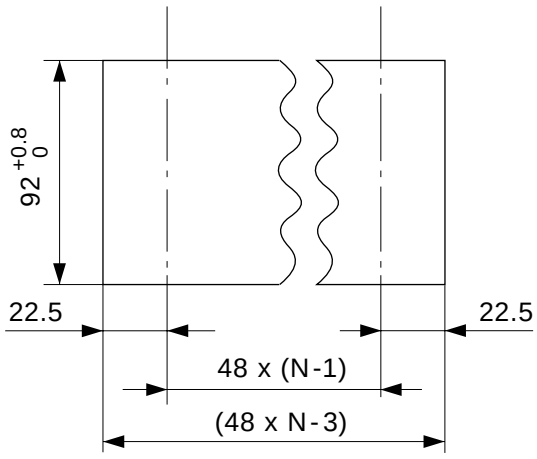


Unit: mm

! HANDLING PRECAUTIONS

When gang-mounting, make sure that the controller is used in an operating temperature of 40°C or below.

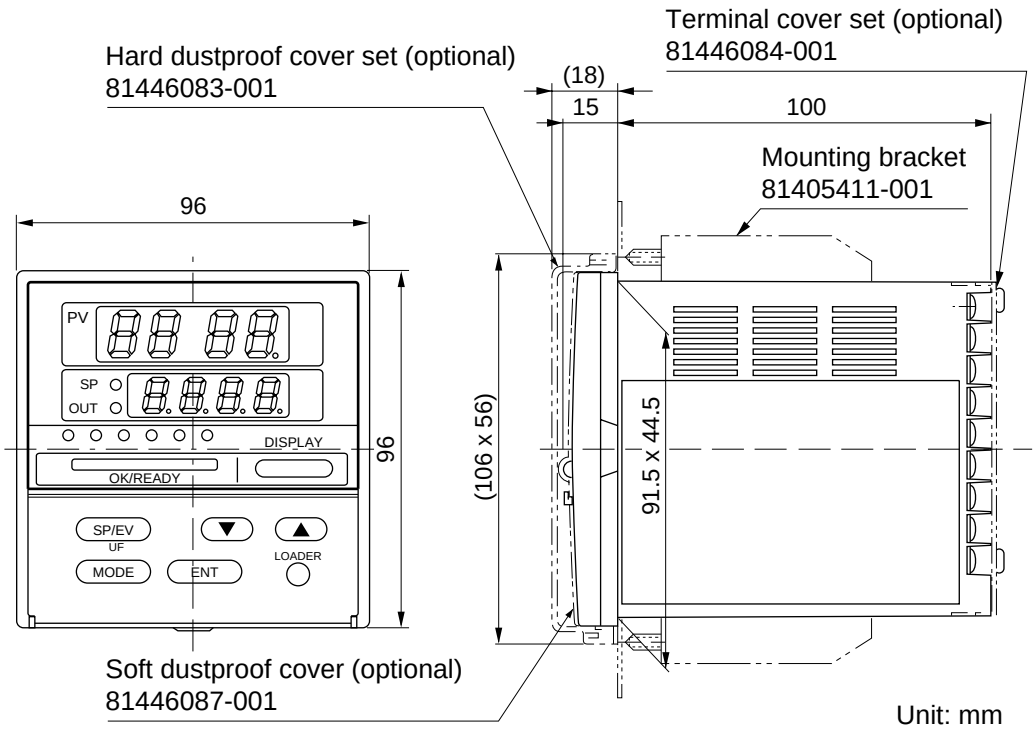
Panel cutout size for closed mounting
(Recommendable sizes)



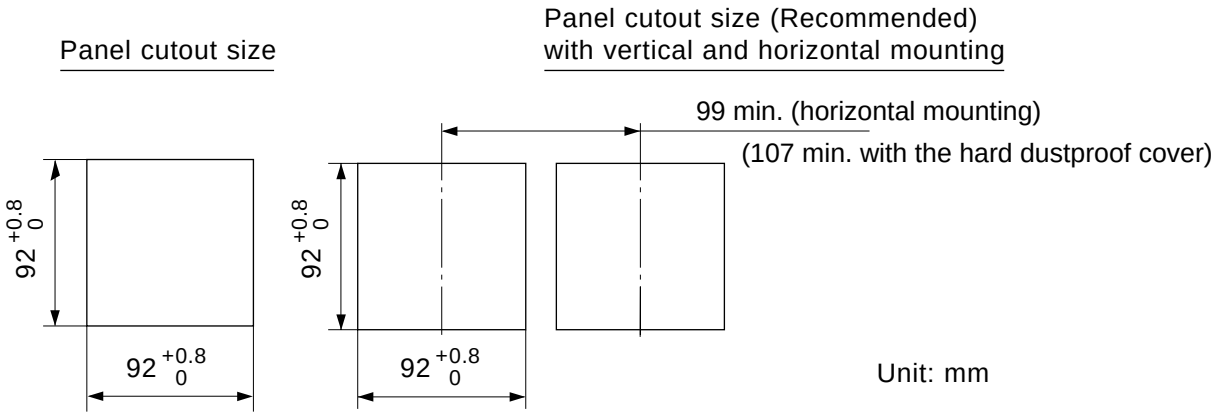
N: No. of mounting units

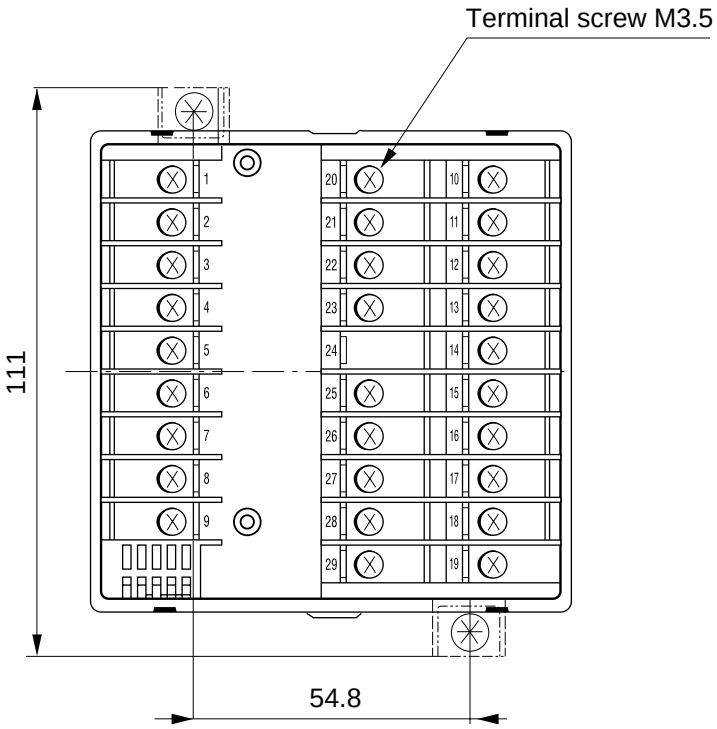
Unit: mm

2-3 SDC31 External Dimensions



2-4 SDC31 Panel Cutout Dimensions



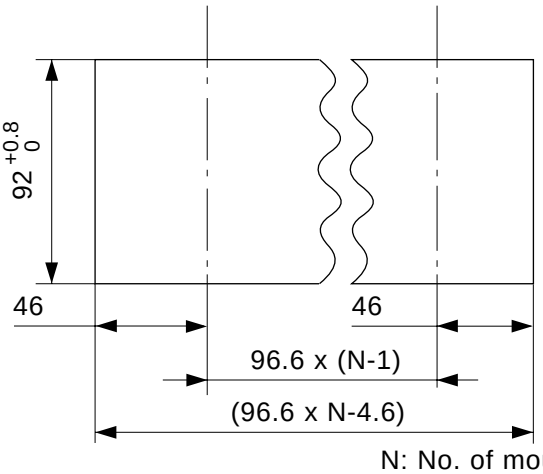


Unit: mm

! HANDLING PRECAUTIONS

When gang-mounting, make sure that the controller is used in an operating temperature of 40°C or below.

Panel cutout size for closed mounting
(Recommended sizes)



N: No. of mounting units

Unit: mm

2-5 Mounting

⚠ CAUTION

Use the SDC30/31 within the operating ranges recommended in the specifications (temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc.). Doing so might cause fire or faulty operation.

Do not block ventilation holes.
Doing so might cause faulty operation.

■ Location of mounting

Mount the instrument at a location which satisfies the following conditions.

- Not subject to high or low temperatures, or high or low humidity.
- Free of corrosive gas (sulfide gas, etc.)
- Free of dust particles, soot, or the like.
- Not exposed to direct sunlight or the weather.
- Free of mechanical vibrations.
- Do not mount instrument near a high-tension line, a welder, or electrical noise generating sources.
- Make sure the instrument is more than 15 meters from a boiler or other high-voltage ignition devices.
- The location should not be subject to a strong magnetic field.
- The location should not be subject to inflammable liquids or gases.

■ Mounting method

- Mount the instrument so that it does not tilt horizontally more than 10° (+ or -).
- Use a steel panel with a plate thickness of more than 2 mm.

! HANDLING PRECAUTIONS

To fasten this controller onto the panel, tighten mounting bracket (supplied) screw, and turn one more turn when there is no play between the bracket and panel. Excessively tightening the screw may deform the controller case.

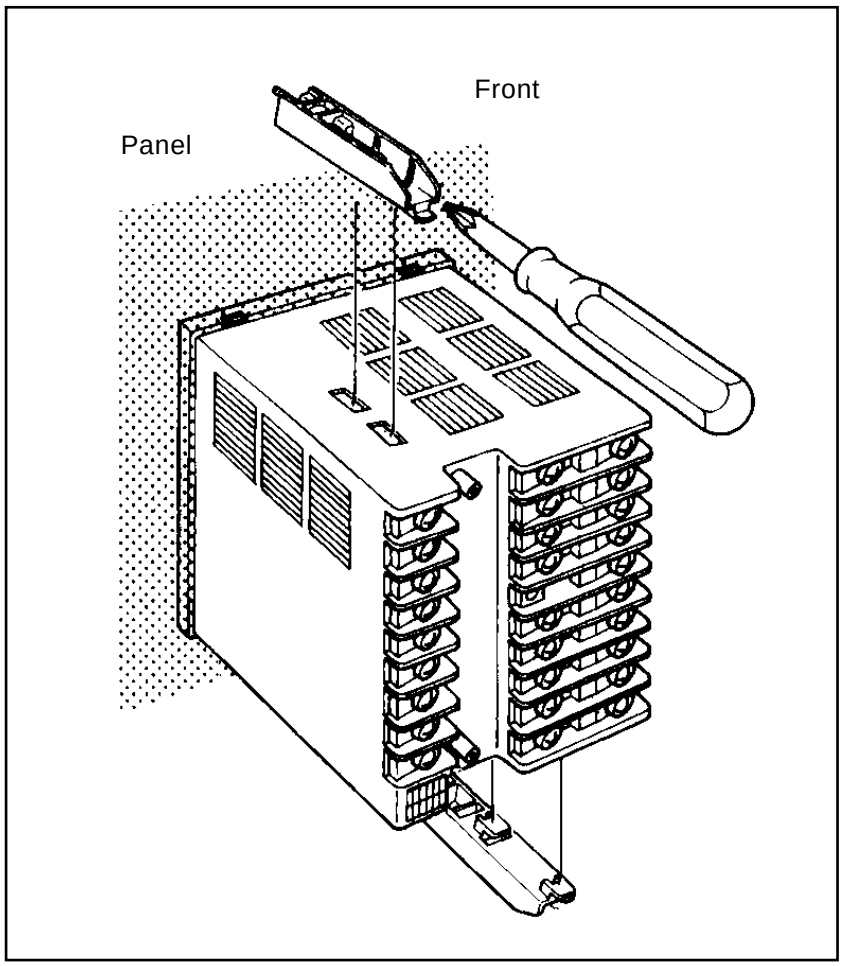
■ Dustproof Cover

Use the dustproof cover (option) when using the controller in a dusty or dirty location, and to prevent inadvertent operation.

Two dustproof covers are provided, hard or soft, each with the following differing functions.

Type	Checking of Display	Operation
Hard	○	X
Soft	○	○

○ indicates that a function can be used.



Mounting method (SDC31)

Chapter 3 WIRING

⚠ WARNING

Do not touch electrically charged parts such as the power terminals. Doing so might cause electric shock.

⚠ CAUTION

Wire the SDC30/31 properly according to predetermined standards. Also wire the SDC30/31 using designed power leads according to recognized mounting methods.
Failure to do so might cause electric shock, fire or faulty operation.

Do not allow lead clippings, chips or water to enter this controller case.
Doing so might cause fire or faulty operation.

We recommend attaching the terminal cover (sold separately) after wiring the SDC30/31.
Failure to do so might cause electric shock.

HANDLING PRECAUTIONS

- Before wiring the SDC30/31, check the controller catalog No. and terminal Nos. on the label on the rear of the body. After wiring the SDC30/31, be sure to check the wiring for any mistakes.
- Maintain a distance of at least 50 cm between I/O leads or communications leads and power leads of 100V or more. Also, do not pass these leads through the same piping or wiring duct.

Be sure to provide a switch within operator reach for shutting OFF the mains power supply of this controller in the main supply wiring.

Also, In case of AC power supply models, the main supply wiring also requires a slow-operating type (T) fuse (rated current: 0.5 A, rated voltage: 250 V). (IEC127)

The following table shows the meaning of the symbols in the terminal wiring label on the instrument side.

Symbol	Description
~	Alternating current
⎓	Direct current
⏚	Earth (ground) terminal
⚠	Caution, risk of electric shock
⚠	Caution

3-1 Cables

Connect thermocouple wires to the terminals in case of a thermocouple input.

When a thermocouple is connected to terminals, or wiring is extended, connect the wires via a shielded compensating lead wire.

- For input/output other than thermocouples, use a shielded polyethylene insulated vinyl shielded cable for instrumentation use conforming to JCS-364 or equivalent (generally called twisted shielded cable for instrumentation use).
- A shielded multiconductor microphone cord (MVVS) may be used, if electromagnetic induction noise are comparatively low.

Recommended twisted shielded cables

Fujikura Cable Co.	2 conductors	IPEV-S—0.9 mm^2 x 1P
	3 conductors	ITEV-S—0.9 mm^2 x 1T

Hitachi Cable Co.	2 conductors	KPEV-S—0.9 mm^2 x 1P
	3 conductors	KTEV-S—0.9 mm^2 x 1T

3-2 Terminal Connections

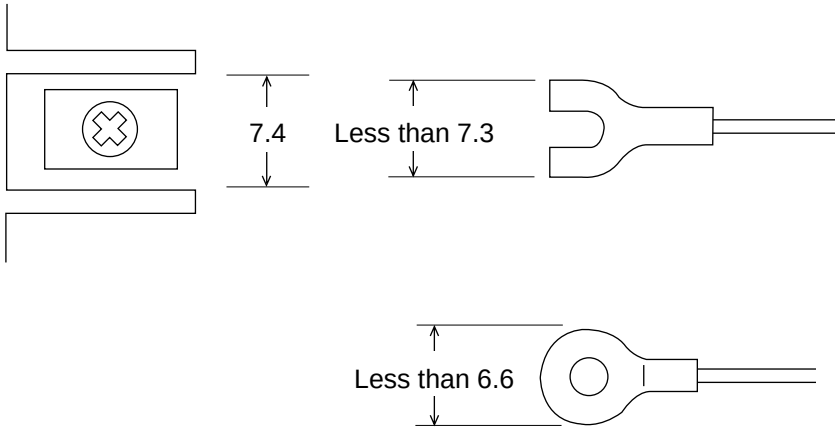
⚠ CAUTION

Firmly tighten the terminal screws at the torque listed in the specifications.
Insufficient tightening of terminal screws might cause electric shock or fire.

Do not use unused terminals on the SDC30/31 as relay terminals.
Doing so might cause electric shock, fire or faulty operation.

We recommend attaching the terminal cover (sold separately) after wiring the SDC30/31.
Failure to do so might cause electric shock.

Use a crimped style solderless terminal compatible with M3.5 screw.



Unit: mm

HANDLING PRECAUTIONS

- When installing the SDC30/31 in locations subject to vibration or impact, be sure to use round crimped terminals to prevent the lead from coming loose from the terminal.
- When wiring with crimped terminals, take care to prevent contact with adjacent terminals.

3-3 Terminal Arrangement

SDC30 (48 x 96)

1	10
2	11
3	12
4	13
5	14
6	15
7	16
8	17
9	18
	19

SDC31 (96 x 96)

1		20	10
2		21	11
3		22	12
4		23	13
5		24	14
6		25	15
7		26	16
8		27	17
9		28	18
		29	19

3-4 Power Supply Connections

⚠ WARNING

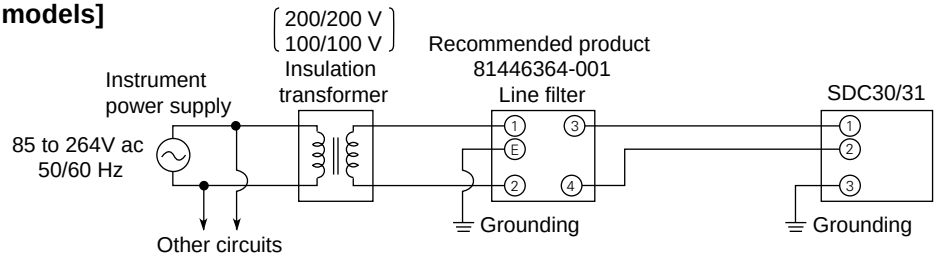
Before wiring, or removing/mounting the SDC30/31, be sure to turn the power OFF. Failure to do so might cause electric shock.

! HANDLING PRECAUTIONS

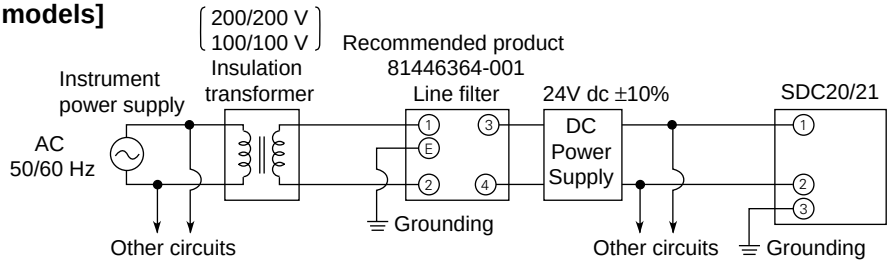
- Connect the SDC30/31 AC power supply models to a single-phase power supply for instruments, and take measures to prevent the influence of electrical noise.
- Connect the SDC30/31 24V dc power supply models to a 24V dc ±10% power source.
- If the power supply generates a lot of electrical noise, we recommend inserting an insulating transformer in the power circuit and using a line filter.

  Recommended line filter: Yamatake Corporation, catalog No. 81446364-001
- After providing anti-noise measures, do not bundle primary and secondary power leads together, or pass them through the same piping or wiring duct.

[AC Power supply models]



[24V dc Power supply models]



Reducing electrical noise

3-5 Grounding

⚠ CAUTION

Before connecting the SDC30/31 to the measurement target or external control circuits, make sure that the FG terminal is properly grounded (100 Ω max.).
Failure to do so might cause an electric shock or fire.

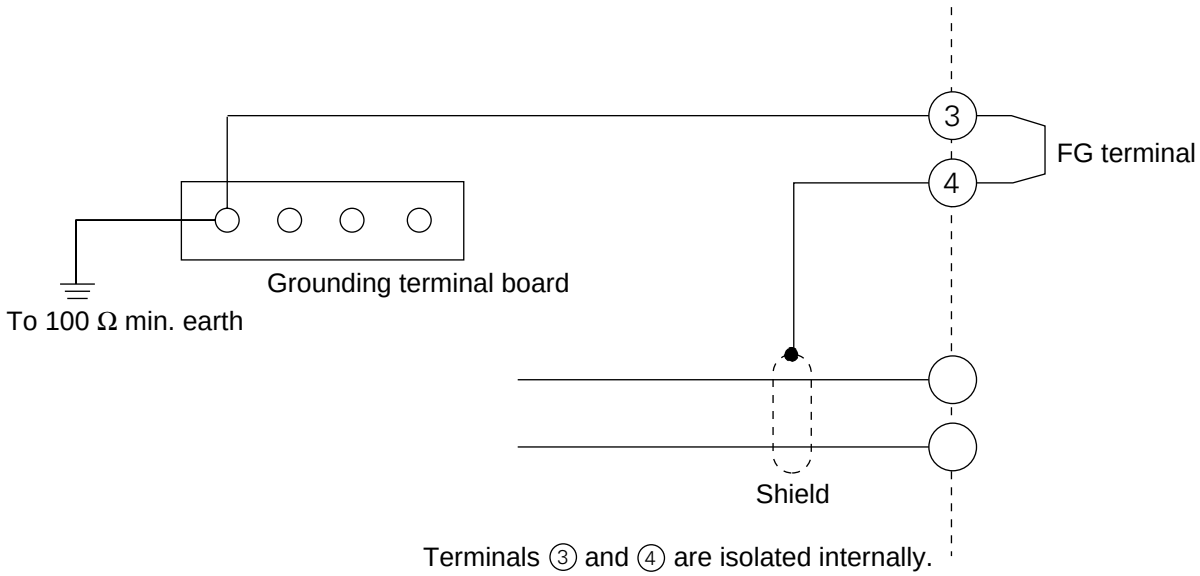
HANDLING PRECAUTIONS

- Use only the FG terminals ③ and ④ on the SDC30/31 for grounding. Do not ground across other terminals.
- When it is difficult to ground shielded cable, prepare a separate ground terminal (earth bar).

  Ground type: 100 Ω max.

  Ground cable: 2 mm² min soft-copper wire (AWG14)

  Cable length: Max. 20 m

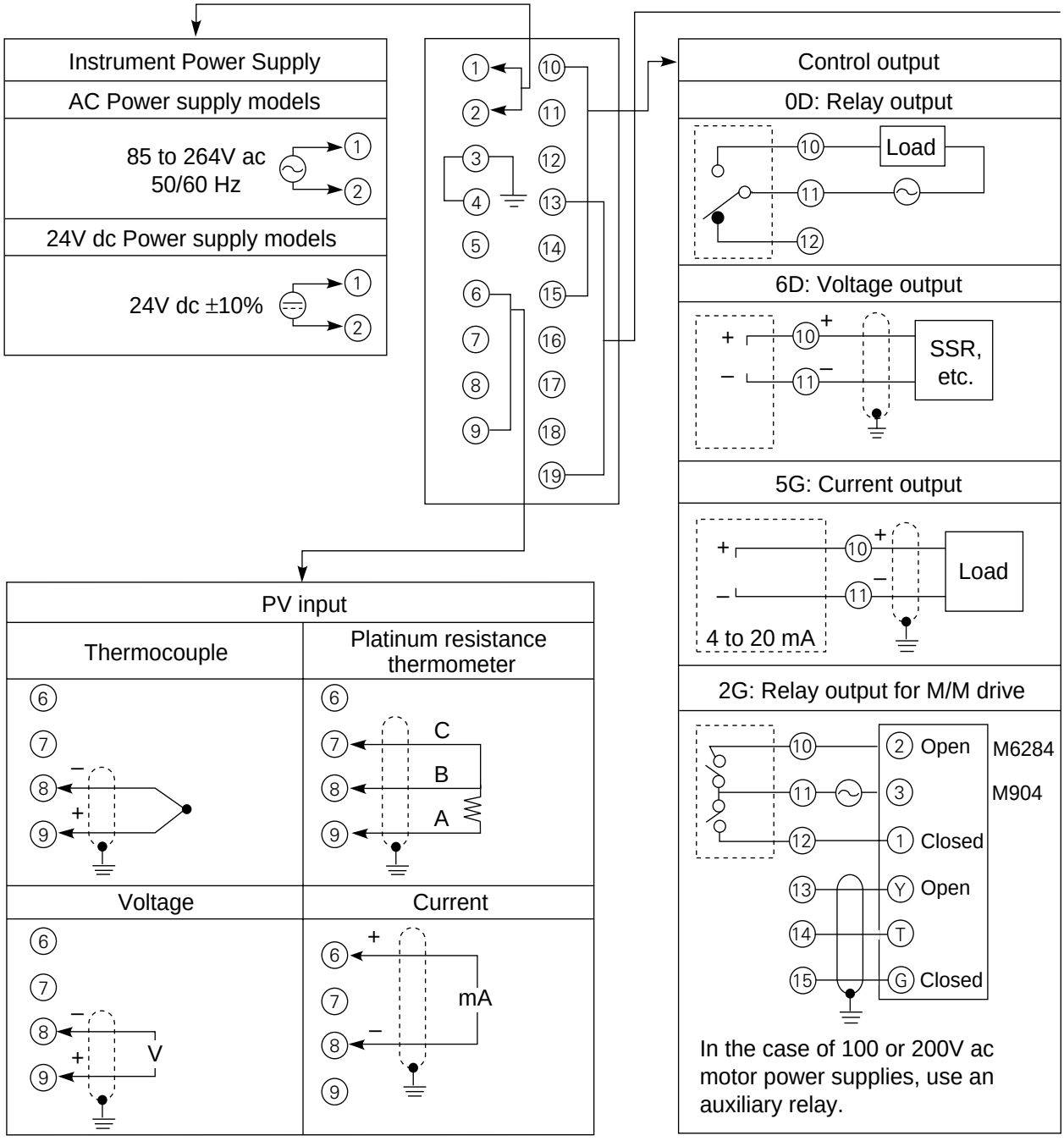


3-6 SDC30 Wiring

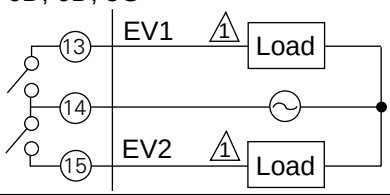
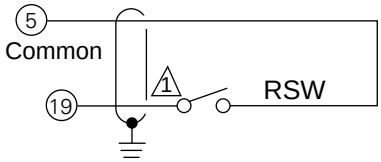
⚠ CAUTION

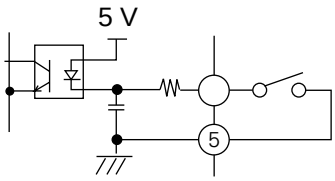
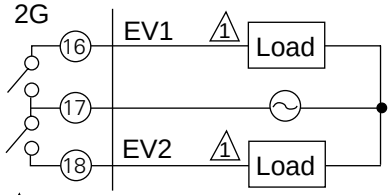
Use the relays on the SDC30/31 within the service life listed in the specifications.
Continued use of the relays after the recommended service life might cause fire or faulty operation.

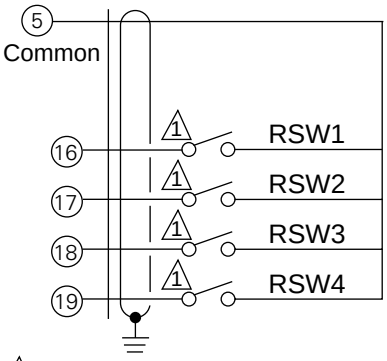
Inputs to the current input terminals ⑥ and ⑧ on the SDC30/31 should be within the current and voltage ranges listed in the specifications.
Doing so might cause fire or faulty operation.

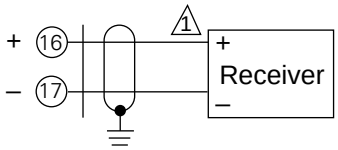


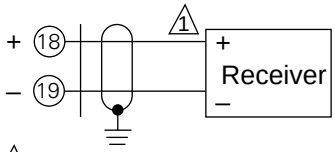
To next page

<table>
<tr><th colspan="4">Options (additional functions)</th></tr>
<tr><th>Event Output EV1</th><th>Remarks</th><th>External Switch Input (1 input)</th><th>Remarks</th></tr>
<tr><td>0D, 6D, 5G
 
</td><td>001
002
003
004
041
402
406
502
506</td><td rowspan="2"> 

1 OFF voltage: 5 ±1 V,
ON current: 5 ±2 mA
Internal circuit
 
</td><td rowspan="2">002
004
402
502</td></tr>
<tr><td>2G
 

1 EV2 is not provided with SPST relay contact 250V ac 5 A resistance load additional functions 407, 507.</td><td>001
002
(407)
(507)</td></tr>
<tr><th>External Switch Input (4 inputs)</th><th></th><th>Auxiliary Output</th><th></th></tr>
<tr><td> 

1 OFF voltage: 5 ±1 V,
ON current: 5 ±2 mA</td><td>003</td><td>Additional function 004
 

Additional function 406, 506
 

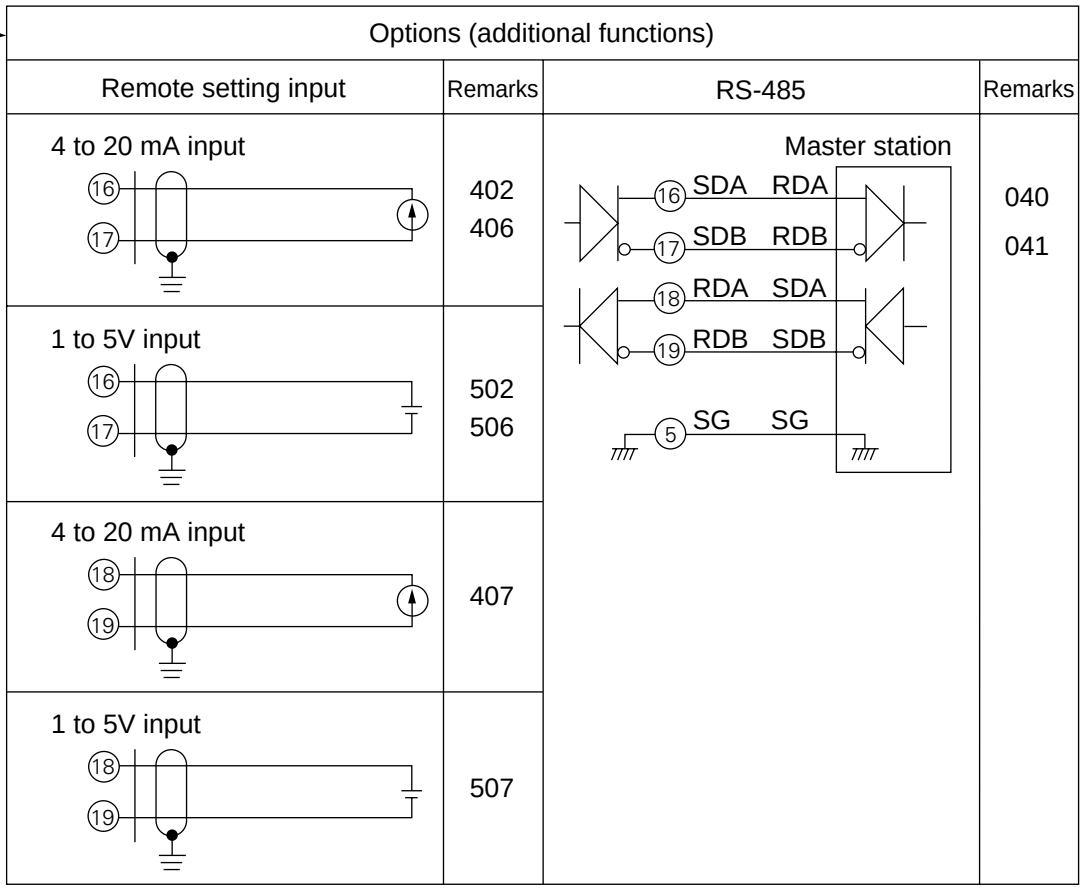
1 4 to 20 mA dc,
load resistance 750 Ω max.</td><td>004
406
506</td></tr>
</table>

! HANDLING PRECAUTIONS

- Current output (5G) and auxiliary output, and voltage output (6D) and auxiliary output are not isolated. Provide isolation if necessary. For details, see 8-2 Specifications, I/O Isolation.
- The SDC30/31 series can be connected in parallel with models in the same series or models in the SDC20/21 series.

  When connecting in parallel with other controllers, thoroughly check the conditions of the other controller before configuring the control system.

  The SDC30/31 series cannot be connected in parallel with the SDC40 and DCP30 series.
- Be sure to use no-voltage contacts for external contacts, and to use those contacts for small-current (if external contacts are available).
- When the load on the voltage output (6D) is an SSR, check the SSR specifications before determining the number of SSRs that can be connected.



For a more detailed description of RS-485 wiring, see 3-8 RS-485 Wiring.

! HANDLING PRECAUTIONS

- When the auxiliary output of this controller is input into an A/D converter or an analog scanner, variances in read-out data occurs, according to the device which is used in combination, causing inconvenience.
- Especially in the case of combination with a successive approximation type high speed A/D converter.

  Therefore, combination with a low speed integration type A/D converter is highly recommended. Be sure to confirm the operation in advance by carrying out a combination test before actual use. Should variation trouble occur,the following countermeasures will be effective:

  (1) Provide an isolator having no switching power supply between this controller and the device to be used in combination

  (2) Provide a film capacitor of 0.01uF to 0.1uF between the input terminal of the device to be used in combination and the earth (Use a capacitor of rated voltage 250V min.).

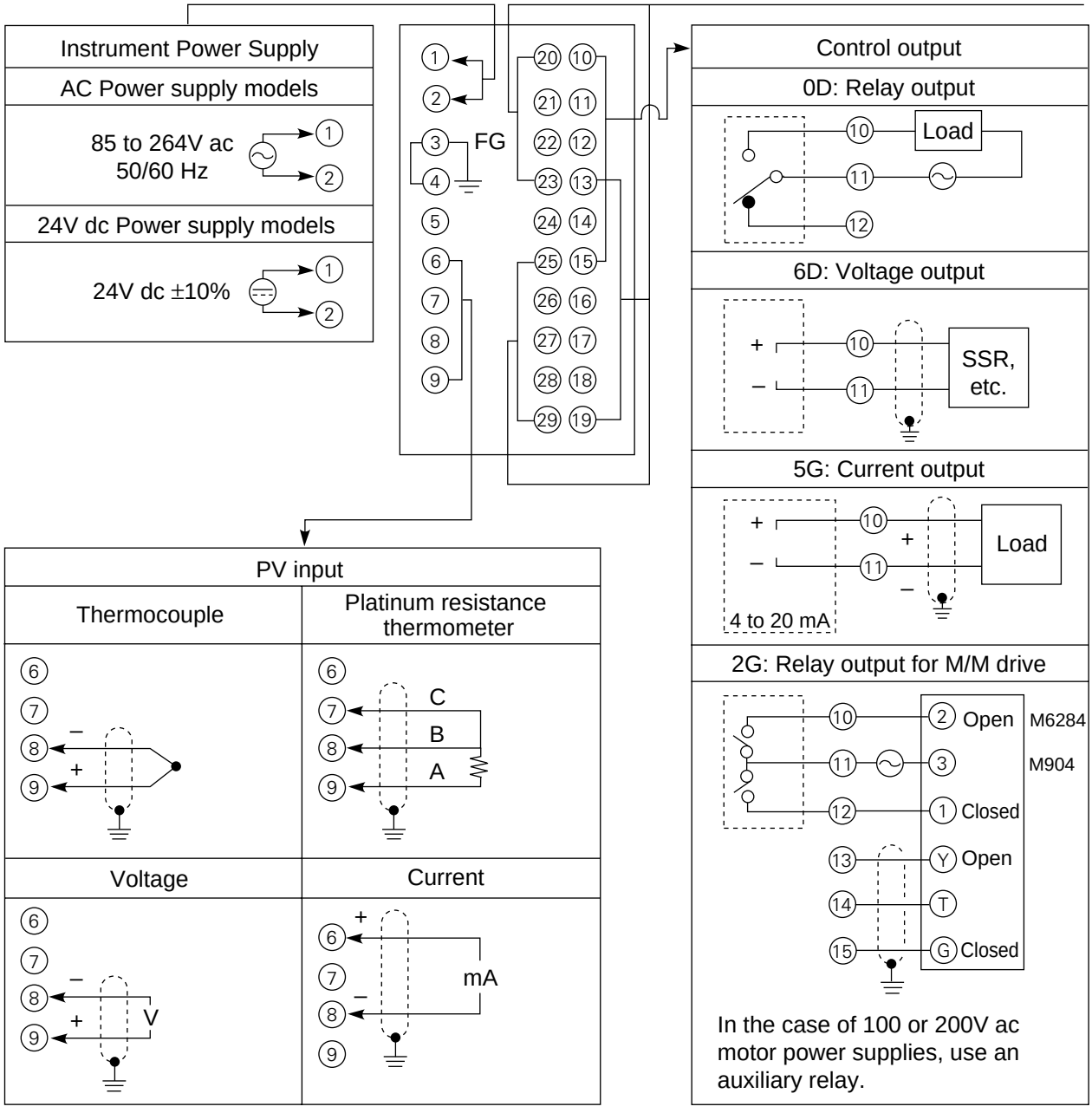
  (3) Make an averaging process by a personal computer at data read-out.

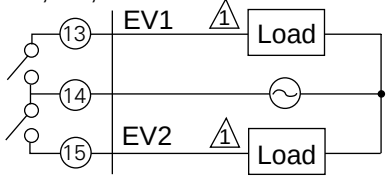
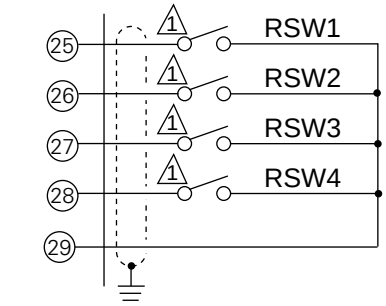
3-7 SDC31 Wiring

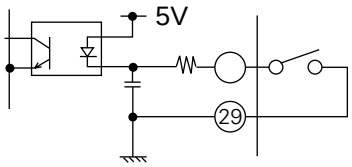
⚠ CAUTION

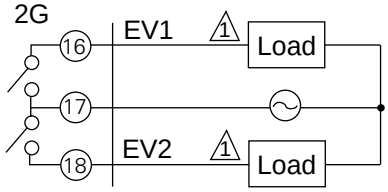
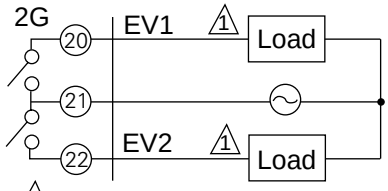
Use the relays on the SDC30/31 within the service life listed in the specifications.
Continued use of the relays after the recommended service life might cause fire or faulty operation.

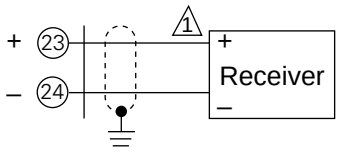
Inputs to the current input terminals ⑥ and ⑧ on the SDC30/31 should be within the current and voltage ranges listed in the specifications.
Doing so might cause fire or faulty operation.

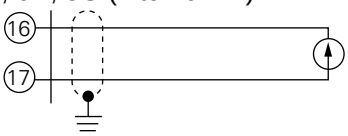
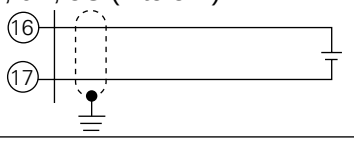
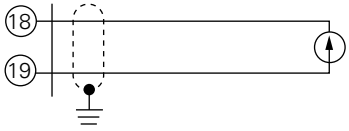
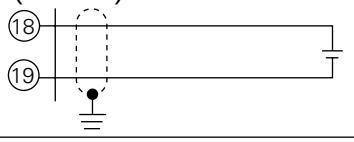


<table>
<tr><th colspan="4">Options (additional functions)</th></tr>
<tr><th>Event Output</th><th>Remarks</th><th>External Switch</th><th>Remarks</th></tr>
<tr>
<td>0D, 6D, 5G
 
</td>
<td>001
003
005
045
(405)
(446)
(546)
(Note)</td>
<td rowspan="3"> 

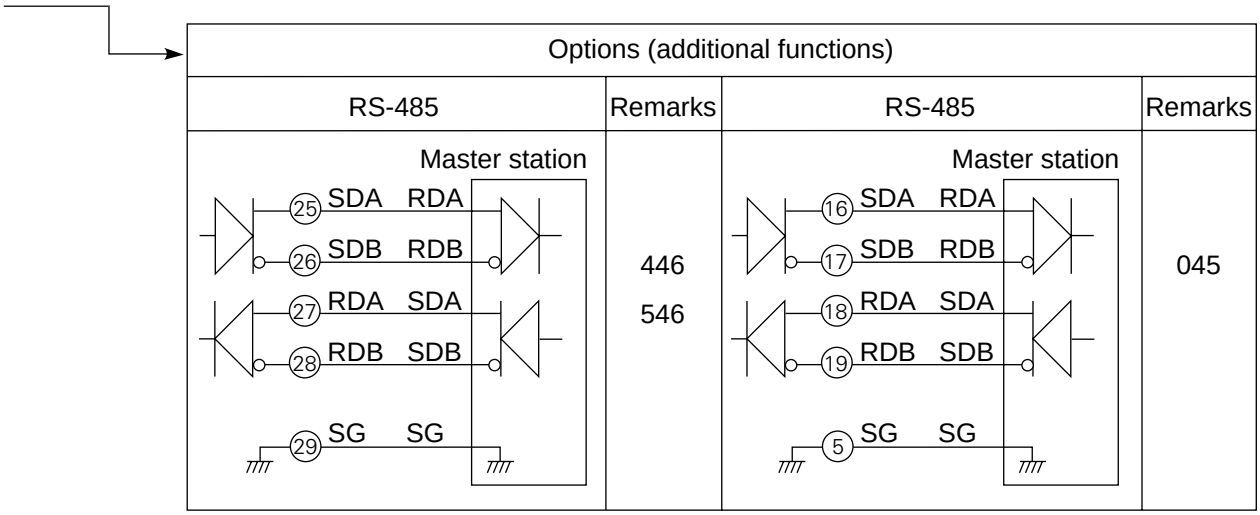
1 OFF voltage: 5 ±1 V,
ON current: 5 ±2 mA
Internal circuit
 
</td>
<td rowspan="3">003
005
045
405
505

(Note)</td>
</tr>
<tr>
<td>2G
 
</td>
<td>001
003
005</td>
</tr>
<tr>
<td>2G
 

1 SPST relay contact 250V ac,
5 A resistance load</td>
<td>045
405
446
505
546</td>
</tr>
<tr>
<th>Auxiliary Output</th><th></th><th>Remote Setting Input</th><th></th>
</tr>
<tr>
<td rowspan="4"> 

1 4 to 20 mA dc, load resistance
750 Ω max.</td>
<td rowspan="4">005
045
405
446
505
546</td>
<td>0D, 6D, 5G (4 to 20 mA)
 
</td>
<td>405
446
(Note)</td>
</tr>
<tr>
<td>0D, 6D, 5G (1 to 5 V)
 
</td>
<td>505
546
(Note)</td>
</tr>
<tr>
<td>2G (4 to 20 mA)
 
</td>
<td>405
446</td>
</tr>
<tr>
<td>2G (1 to 5 V)
 
</td>
<td>505
546</td>
</tr>
</table>

(Note) 405, 446, 505 and 546 cannot be selected on 6D output models.



For a more detailed description of RS-485 wiring, see 3-8 RS-485 Wiring.

! HANDLING PRECAUTIONS

- Current output (5G) and auxiliary output, and voltage output (6D) and auxiliary output are not isolated. Provide isolation if necessary. For details, see 8-2 Specifications, I/O Isolation.
- The SDC30/31 series can be connected in parallel with models in the same series or models in the SDC20/21 series.

  When connecting in parallel with other controllers, thoroughly check the conditions of the other controller before configuring the control system.

  The SDC30/31 series cannot be connected in parallel with the SDC40 and DCP30 series.
- Be sure to use no-voltage contacts for external contacts, and to use those contacts for small-current (if external contacts are available).
- When the load on the voltage output (6D) is an SSR, check the SSR specifications before determining the number of SSRs that can be connected.
- When the auxiliary output of this controller is input into an A/D converter or an analog scanner, variances in read-out data occurs, according to the device which is used in combination, causing inconvenience.
- Especially in the case of combination with a successive approximation type high speed A/D converter.

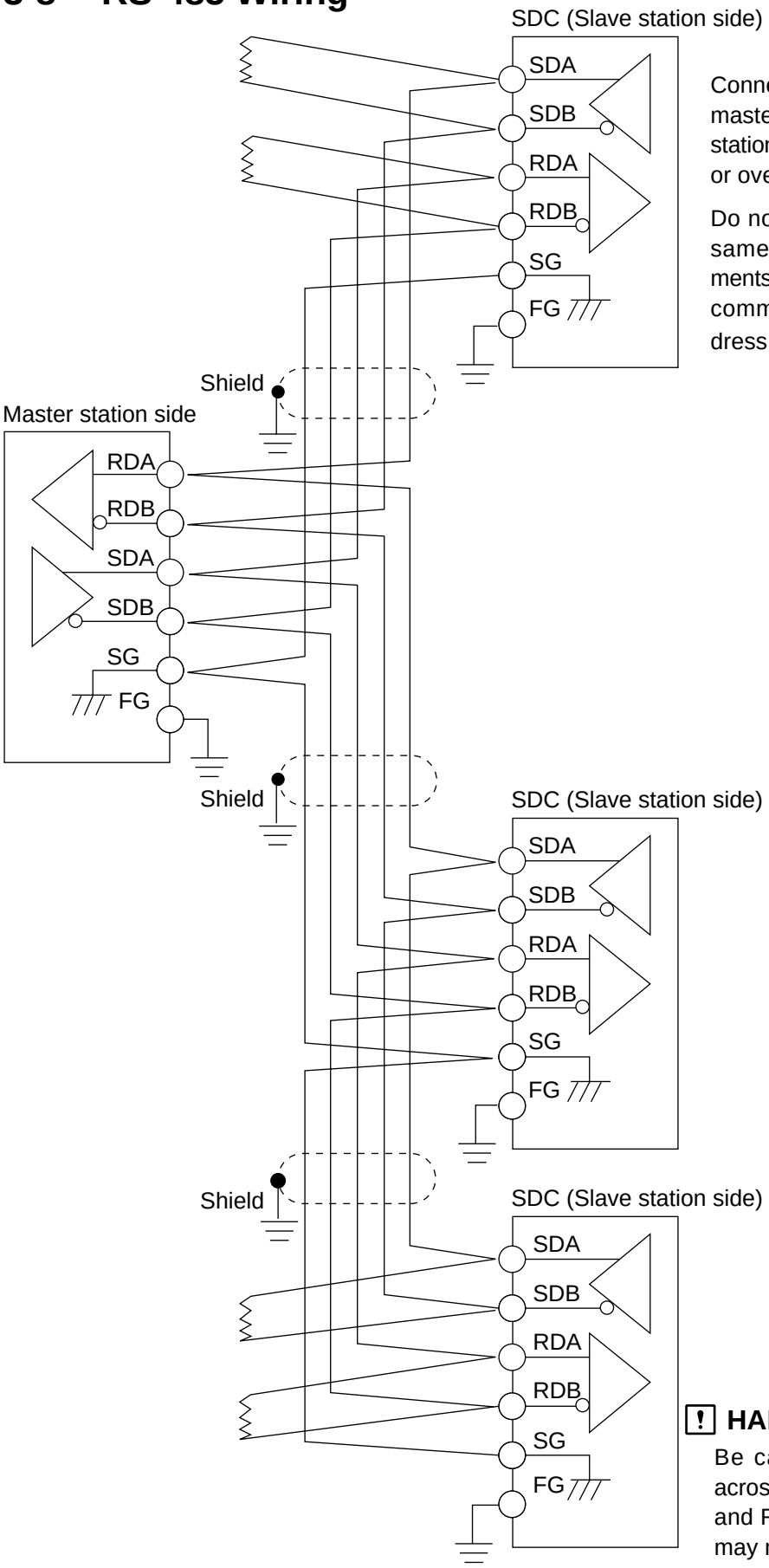
  Therefore, combination with a low speed integration type A/D converter is highly recommended. Be sure to confirm the operation in advance by carrying out a combination test before actual use. Should variation trouble occur,the following countermeasures will be effective:

  (1) Provide an isolator having no switching power supply between this controller and the device to be used in combination

  (2) Provide a film capacitor of 0.01uF to 0.1uF between the input terminal of the device to be used in combination and the earth (Use a capacitor of rated voltage 250V min.).

  (3) Make an averaging process by a personal computer at data read-out.

3-8 RS-485 Wiring



Connect a terminating resistor in the master station and the farthest slave station. Use a resistor of 150 Ω, 1/2W or over.

Do not assign the SDC30/31 to the same address as the other instruments connected to the same RS-485 communication line (excluding address 0).

! HANDLING PRECAUTIONS

Be careful not to short terminals across SDA and SDB or across RDA and RDB, otherwise this instrument may malfunction.

3-9 Countermeasures Against Noise

⚠ CAUTION

Use Yamatake Corporation's SurgeNon if there is the risk of power surges caused by lightning.
Failure to do might cause fire or faulty operation.

The following noise generation sources are the most common.

① Relay and contacts
② Solenoid coils and solenoid valves
③ Power line (higher than 100V ac, in particular)
④ Inductive load
⑤ Motor commutator
⑥ Phase angle control SCR
⑦ Radio communication equipment
⑧ Welding machine
⑨ High-voltage ignition devices

The following methods are effective as countermeasures against noise.

① A CR filter is effective for quick-rising noises such as impulse noise.

Recommended CR filter
Yamatake Corporation Model No. 81446365-001

② A variator is effective for noises with high crest values.

Recommended variator
Yamatake Corporation Model No. 81446366-001 (for 100V)
81446367-001 (for 200V)

HANDLING PRECAUTIONS

Be careful when using varistors as they may short-circuit if the controller malfunctions.

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Chapter 4 SETTING THE SETUP ITEMS

This chapter provides descriptions on the setup items required for the instrument built in an equipment for the first time to be put in operating states.

! HANDLING PRECAUTIONS

- It is necessary to set the operating conditions such as the input range and control action according to how to use the equipment, before operating the instrument. This is called a setup.

  If the instrument has already been built in and its setup has been completed, this chapter may be skipped.

- When using a 2G model, adjust the motor position (setup item C36).

  2G models do not operate normally in their shipped state.

- When the motor hunts on a 2G model, carry out the following:

  - Re-adjust the motor position. (External causes sometimes prevent the correct adjustment value from being obtained.)
  - Increase the dead zone (setup item C34). (The standard value is 10.0%. If the dead zone is set to a smaller value, revert the value to 10.0%.)
  - Re-adjust PID. (If the adjustment is out, output will change unnecessarily, causing the motor to hunt.)

4-1 Setup Operation

Before starting the setup, check the items and set values, which are necessary for the equipment to be used, in accordance with the setup items table.

Determine the setup values in advance, using the “Setting Work Sheets" at the end of this manual as an appendix.

- To execute the setup, place this instrument in the basic indication states.

  The basic indication states means such that the No.1 indicator shows a PV, and No.2 indicator shows an SR, OUT or a heater current value.

  If the instrument is not in the basic indication states, press the DISP key.

- There are 51 setup items from C01 to C51 (including missing numbers).

  Among these items, set the necessary items only. Some items may use the initial values as they are.

- If there is no relevant item due to a special model, this Item No. is not indicated, but skipped.

  Setup item C51 is used for factory adjustment.

  After C51, C01 follows.

4-2 Setup Table

Setup item	Indication	Action	Reference page
Key lock	C01	Sets whether or not key operation is enabled.	4-6
Temperature unit	C02	Selects °C or °F.	4-6
Control action	C03	Determines the direction of control action.	4-6
Type of PV input range	C04	Determines the type and range of a PV input.	4-6
Decimal point position	C05	Determines the decimal point position in PV, SP indication.	4-8
PV range lower-limit	C06	Determines the PV input range.	4-8
PV range high-limit	C07	Determines the PV input range.	4-8
SP setting system	C08	Sets either single SP or multi SP.	4-8
Lower-limit of SP	C09	Determines an SP setting range.	4-9
Upper-limit or SP	C10	Determines an SP setting range.	4-9
Selection of control output in case of PV abnormal	C11	Selects the type of output when a PV input is abnormal.	4-9
Setting of control output at READY and PV abnormal	C12	Determines the control output at READY or PV abnormal.	4-9
Manual initial control output selection	C13	Determines bump-less or preset when the mode is changed from AUTO to MANUAL.	4-10
Preset manual value	C14	Determines the control output when the mode is changed from AUTO to MANUAL by preset.	4-10
Initial manipulated variable in PID operation	C15	Determines the initial manipulated variable in PID operation when the power is turned ON, when auto-tuning ends or when the mode is switched from READY to RUN.	4-10
PID operation initialize	C16	Selects how to initialize PID operation when the SP value is changed.	4-10
Zone PID operation	C17	Determines zone PID ON/OFF.	4-11
Control method selection	C18	Selects the function for inhibiting over-shoot during control.	4-11
Independent 2-degrees of freedom PID operation selection	C19	Determines independent 2-degrees of freedom PID ON/OFF.	4-13
Neural network auto-tuning operation selection	C20	Determines neural network auto-tuning ON/OFF.	4-13
Event 1 type	C21	Determines the type of event 1.	4-14
Event 1 standby operation selection	C22	Determines event output 1 standby operation ON/OFF.	4-16
Event 2 type	C23	Determines the type of event 2.	4-14
Event 2 standby operation selection	C24	Determines event output 2 standby operation ON/OFF.	4-16
Event operation at READY	C25	Determines the event operation at READY.	4-17
Number of SPs selectable by external switch input	C26	Selects the number of LSPs that can be selected by the remote switch.	4-17

Setup item	Indication	Action	Reference page
External switch input 1 function	C27	Determines the function of external switch input 1.	4-18
External switch input 2 function	C28	Determines the function of external switch input 2.	4-18
External switch input 3 function	C29	Determines the function of external switch input 3.	4-18
External switch input 4 function	C30	Determines the function of external switch input 4.	4-18
Communication address	C31	Determines the communication address.	4-18
Transmission speed	C32	Determines the communication speed.	4-18
Communication code	C33	Determines the type of communication code.	4-18
Dead zone	C34	Determines the dead zone in position-proportional output.	4-19
Modular control motor control method selection	C35	Selects the control method of the modular control motor.	4-19
Modular control motor start of automatic adjustment	C36	Starts adjustment of the modular control motor.	4-20
Modular control motor fully closed adjusted value	C37	Determines the adjusted value at the fully closed position of the the modular control motor.	4-20
Modular control motor fully open adjusted value	C38	Determines the adjusted value at the fully open position of the the modular control motor.	4-20
Modular control motor fully open/closed time	C39	Determines the time from the fully closed to the fully open position of the modular control motor.	4-21
SP ramp up gradient	C40	Determines the up gradient of the SP ramp.	4-21
SP ramp down gradient	C41	Determines the down gradient of the SP ramp.	4-21
SP ramp time unit selection	C42	Determines the time unit of SP ramp.	4-22
Green belt	C43	The green belt lights when this value is lower than a specified value.	4-22
Auxiliary output type	C44	Determines the type of auxiliary output.	4-23
Value of signal source at 4 mA auxiliary output	C45	Determines the value at which the auxiliary value becomes 4 mA.	4-23
Value of signal source at 20 mA auxiliary output	C46	Determines the value at which the auxiliary value becomes 20 mA.	4-23
RSP value at 0% input	C47	Determines the SP value corresponding to RSP0% (4 mA, 1 V).	4-23
RSP value at 100% input	C48	Determines the SP value corresponding to RSP100% (20 mA, 5 V).	4-24
Cold junction compensation operation selection	C49	Determines cold junction compensation ON/OFF.	4-24
Zener barrier adjustment	C50	Corrects dispersion in Zener barrier resistance value.	4-24
Adjustment code	C51		4-25

4-3 Basic Operation for Setup

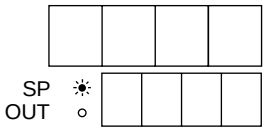
In this instruction manual, the purpose of operation and the operation procedure are given on the left side of page, and the result of operation and the states indicated on the instrument are given on the right side.

The basic operation for set up is as follows;

Operation Procedure

① To set to basic indication status

Press the DISP key.

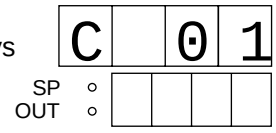


← A PV set value at that time is indicated.
← The set value of that item is indicated.

Note) This procedure is not required when the basic indication is already given.

② To indicate the setup item seconds.

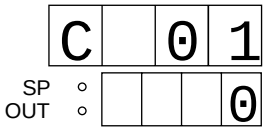
Continuously, press the ENT key and ▼ keys together for 3 seconds.



← C01 is indicated.
← The set value of that item is indicated.

③ To change the set value

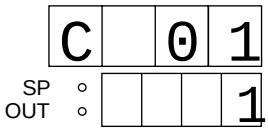
(Jump to step ⑥ in otherwise case), press the ENT key.



← The numeric flashes.

④ To change the set value

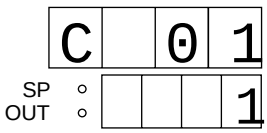
Change the numeric, using the ▲ key or ▼ key.



← Keeps flashing.

⑤ To define the changed numeric

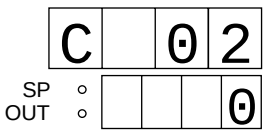
Press the ENT key.
→ Flashing stops and the set value is defined.



← Does not flash.

⑥ To transfer to the next setup item

After making sure that the numeric does not flash, press the ▼ key.



← C02 is indicated in this case.

Note) To reset to the preceding setup item, press the ▲ key.

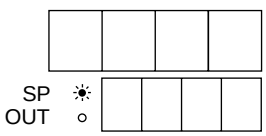
⑦ To change the numeric

Repeat steps ③→④→⑤→⑥

Note) Not to change the numeric, press the ▼ key to transfer to the next setup.

⑧ To reset to basic indication status.

Press the DISP key.



← A PV numeric is indicated.
← An SP numeric is indicated.

NOTE

This is a convenient function to be memorized.

How to use the up (▲) key or down (▼) key.

To change the set values of the indicator, use these key.

When the up (▲) key is pressed once, the numeric is incremented by one. When the down (▼) key is pressed once, the numeric is decremented by one.

When the up (▲) key or down (▼) key is pressed continuously, the numeric in the indicator is continuously incremented or decremented, and more over the changing speed is accelerated gradually.

When this function is used effectively, the set value can be changed greatly and conveniently.

An example is given below.

(Example) To change the numeric from 500 to 1000.

At first	500	
↓		
Press the (▲) key continuously.	506	The numeric begins to increase.
↓		
Release holding from the (▲) key a little before 1000.	972	The numeric stops a little before 1000.
↓		
Press the (▲) key again continuously.	978	The numeric begins to increase.
↓		
Release holding from the (▲) key immediately before 1000.	997	The numeric stops immediately before 1000.
↓		
Press the (▲) key, for example, three times, or for a while.	1000	The numeric stops at 1000.

4-4 Description on the Setup Items

Setup of C01 (key lock)

This setup item prevents a set numeric from being changed, although it can be indicated.

The operating conditions are prevented from being changed by an operational error or unnecessary key operation.

0: Operation possible (key lock canceled)

1: Setup items excluding run parameters and this item (C01) cannot be changed.

2: Setup items excluding run parameters and this item (C01), and event set values cannot be changed.

3: All set values excluding this item (C01) cannot be set.

Setup of C02 (temperature unit)

This setup selects °C or °F as temperature unit.

0: °C

1: °F

Check items

- After changing the temperature unit, check if C06, C07 (upper and lower limits of PV input range), C05 (decimal point position),C09, C10 (upper and lower limits of SP limit), event set values and SP set value are correct.
- When selection is done, the upper and lower limits of a PV input range, and the upper and lower limits of an SP range are changed into the full spans.

Setup of C03 (control action)

This setup determines the directions of control action. When the output increases as a PV increases, the control action is called a direct action, and the otherwise control action is called a reverse action.

0: Reverse action

1: Direct action

Check items

Be careful about the relation to the controlled system.

Generally, select the reverse action for heating control, and the direct action for cooling control.

Setup of C04 (type of PV input range)

This setup determines the type of a PV input and the reference temperature range.

Set a desired number in accordance with the input ranges table.

Check items

After changing the input range, check if the upper and lower limits of a PV input range, decimal point position, the upper and lower limits of an SP limit, SP set value and event set values are correct.

Input Ranges Table

C04 No.	Type	°C range	°F range	Assured Precision Range
01	K	0 to 1200	0 to 2200	3/4
02		0.0 to 800.0	0 to 1400	3/4
03		-200.0 to +400.0*	-300 to +700	3/4
04	J	0 to 1200	0 to 2000	1/2
05		0.0 to 800.0	0 to 1400	3/4
06		-200.0 to +400.0*	-300 to +700	1/2
07	E	0.0 to 800.0	0 to 1400	3/5
08	T	-200.0 to +400.0*	-300 to +700	1/2
09	R	0 to 1600	0 to 3000	1/2
10	S	0 to 1600	0 to 3000	3/5
11	B	0 to 1800	0 to 3200	3/4
12	N	0 to 1300	32 to 2372	3/4
13	PLII	0 to 1300	32 to 2372	3/4
14	Wre5-26	0 to 2300	0 to 4000	3/5
15	Wre0-26	0 to 2300	0 to 4000	3/5
16	Ni-Mo	0 to 1300	32 to 2372	1/2
17	DIN U	-200.0 to +400.0*	-300 to +700	1/2
18	DIN L	0.0 to 800.0	0 to 1400	3/4
20	JIS Pt 100	-200.0 to +500.0*	-300 to +700	1/2
21		-100.0 to +200.0	-150.0 to +400.0	1/2
30	JIS JPt 100	-200.0 to +500.0*	-300 to +700	1/2
31		-100.0 to +200.0	-150.0 to +400.0	1/2
40	4 to 20 mA	Scaling and decimal point position are variable within a range of -1999 to 9999.		
41	0 to 20 mA			
45	1 to 5V			
46	0 to 5V			
50	0 to 10 mV			
51	0 to 100 mV			
52	-10 to +10 mV			

! HANDLING PRECAUTIONS

- In the case of type B thermocouples, there are no accuracy restrictions at 260°C (500°F) or less due to the characteristics of B thermocouples.
  This is not displayed when the temperature is less than 20° (°C display) or less than 68°F (°F display.)

Check items

In the ranges with decimal point indication, indication can be performed to one decimal point. Although -200.0 cannot be indicated, the action is normal.

Setup of C05 (decimal point position)

This setup determines whether a decimal point is added to the PV indication and SP indication. With the temperature input, the range shown with a decimal point in the input ranges table can be set to one decimal digit.

A decimal point can be added to any position with a linear input.

0:	With no decimal point	1888
1:	One decimal digit is indicated.	188.8
2:	Two decimal digits are indicated.	18.88
3:	Three decimal digits are indicated.	1.888

Check items

- This setup is disabled, depending upon the contents of setup of C04. See the Check items on page 4-6.
- When changing the decimal point position, check if the upper and lower limits of the input range, the SP set value, the upper and lower limits of the SP limit, event set values, event hysteresis, and SP ramp are correct.

Setup of C06 (lower limit of PV input range)

Setup of C07 (upper limit of PV input range)

With the temperature input, the PV input range can be narrowed.

For example, the reference temperature range of 0.0 to 800.0°C can be narrowed to 0.0 to 500.0°C in No.02 (input type K) of the input ranges table. In such a case, set the lower limit to 0°C, and the upper limit to 500°C.

With the linear input, desired numerics can be assigned to 0% and 100%.

For example, 4 mA can be assigned to 0 and 20 mA to 1000 in case of 4 to 20 mA input. In this case set the lower limit to 0 and the upper limit to 1000.

Check items

- With the temperature input, the input range can be setup to:

  "Upper limit value — Lower limit value ≥ Reference temperature range/4 "
- When changing the upper and lower limits of the PV input range, check if the upper and lower limits of the SP limit, SP set value and event set values are correct.
- When the upper and lower limits of the PV input range has been changed, the PID constant is dependent on the newly changed range. Carry out tuning again.

Setup of C08 (SP setting system)

This setup selects either single SP or multi SP.

0: Single SP

1 to 7: Multi SP

Check items

With multi SP, this set value becomes the maximum SP (PID group) No. that can be set.

Setup of C09 (lower limit of SP limit)

Setup of C10 (upper limit of SP limit)

This setup restricts the setup and indication of SP.

Check items

- Be sure to check C09 and C10 after C04, C06 and CO7 have been changed.
- This setup cannot be done out of the range of C06 and C07. However, when C09 and C10 are set earlier, C06 and C07 may be set to values smaller than the limit values.

Setup of C11 (selection of control output in case of PV abnormal)

This setup item selects whether PID operation results are used or the C12 set value is used when a PV input error (AL01, AL02), cold junction compensation error or RTD input C line input error (AL03), or RSP input error (AL05, AL06) occurs.

0: Normal PID operation value are output in over-range

1: The closed relay continues to stay ON in over-range (when C35=2 on 2G models).

The set value of C12 is output in over-range (in other cases).

2: The open relay continues to stay ON in over-range (when C35=2 on 2G models).

Check items

When C35 is set to 2 (inferred position control) on a 2G model, the above operations will be carried out when an input error occurs or in the READY mode regardless of the set value of C12.

Setup of C12 (setting of control output at READY and PV abnormal)

This setup item sets the output value at READY or when a PV input error occurs.

The unit is %.

0 to 100% 0D, 6D, 2G

-10 to +110% 5G

Check items

PV input error” refers to when one of alarms AL01, AL02, AL03, AL05 and AL06 is output.

Setup of C13 (manual initial control output selection)

This setup item selects the initial control output when the AUTO mode is changed to the MANUAL mode. By the “bumpless” setting, the PID operation results before the mode was changed are output, and by the “preset” setting the set value of C14 is output. Control output is bumpless when the MANUAL mode is changed to the AUTO mode.

0: Bumpless

1: Preset

Check items

- When the power is turned ON again in the MANUAL mode, the set value of C14 is output regardless of this setting.
- When C35 is set to 2 (feedback OFF) on a 2G model, control output will be bumpless regardless of this setting.

Setup of C14 (preset manual value)

This setup item sets the initial manipulated variable when the AUTO mode is changed to the MANUAL mode.

0 to 100% 0D, 6D, 2G

-10 to +110% 5G

Check item

This setup item is valid only when C35 is set to 0 to 1 on 2G models. Preset manual will not operate when C35 is set to 2 (motor feedback OFF).

Setup of C15 (initial manipulated variable in PID operation)

This setup item starts PID operation from this set value in the following instances:

The default can be used as it is at all times. When auto-tuning ends, initialization to set this value as the initial manipulated variable is carried out.

- When READY changes to RUN in the AUTO mode
- When the power is turned ON in AUTO and RUN modes

0 to 100%

Setup of C16 (PID operation initialize)

This setup item determines whether or not to initialize PID operation to prevent the manipulated variable from being swelling when the SP value is changed.

0: Auto

PID operation is not initialized after the PV has stabilized with the absolute value of deviation before the SP change within 2% FS. PID operation is initialized is carried out in all other cases.

1: Initialization when RSP and LSP are switched after the SP is changed

PID operation is initialized when the currently executing SP value or SP group is changed or when the RSP/LSP mode is changed.

2: Not initialized

PID is not initialized in all cases.

Setup of C17 (zone PID operation)

This setup item selects whether or not to used zone PID.

0: Not used

1: Used

Check items

- When "Used" is set, set the run parameter Zone.
- For details, see Zone Setting on page 5-12.

Setup of C18 (control system selection)

This setup item selects the function for suppressing overshoot during control action.

0: Normal PID

1: Overshoot relaxation

Overshoot can be suppressed by a certain amount.

The suppression strength is fixed. However, this setting is effective on numerous control targets.

2: Learning function status

The optimum suppression strength is learned according to the control target.

3 : Fixed learning status

The optimum suppression strength obtained by learning is fixed.

Check items

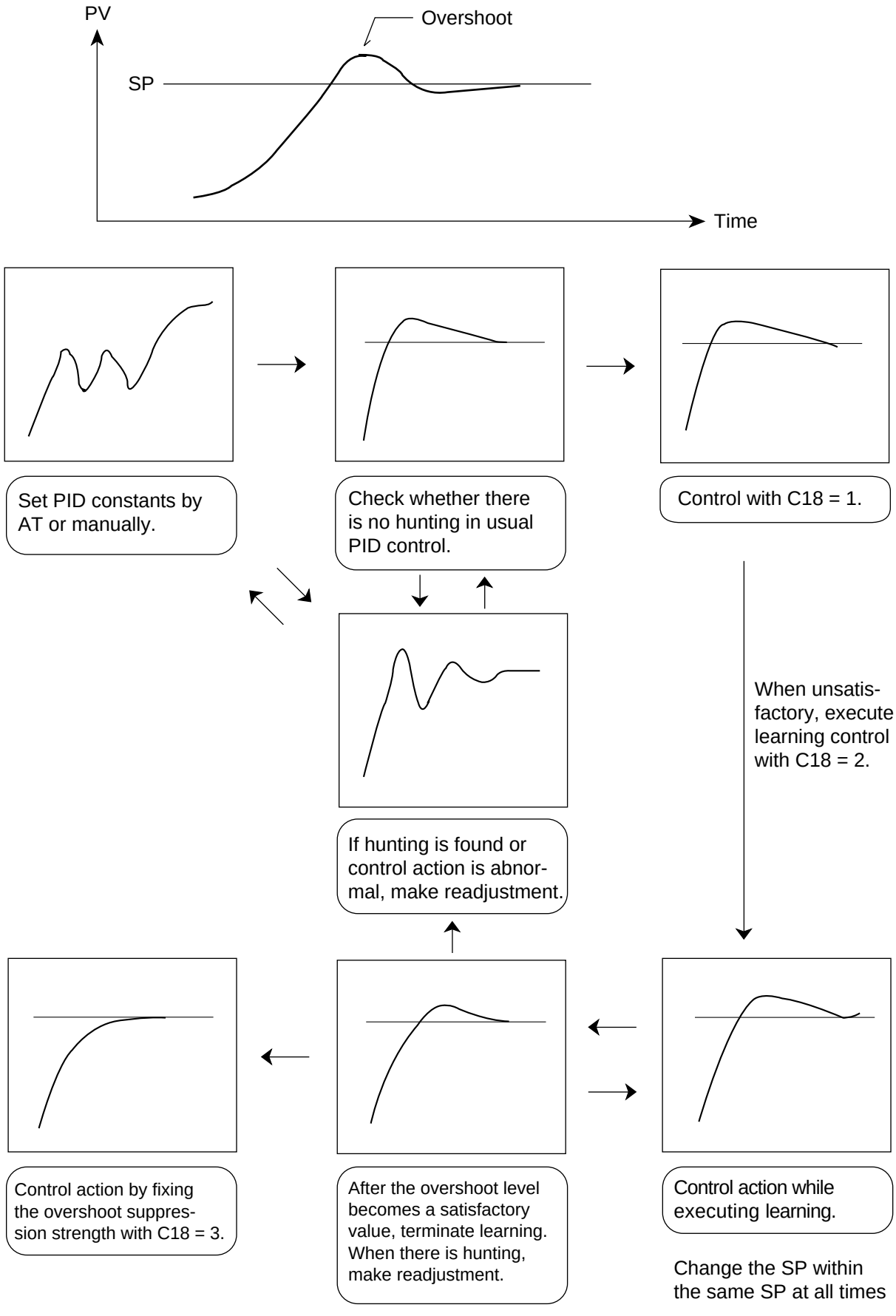
- In the initial control action, operate the controller with C18 set to 0, and check overshoot states.

  When there is an overshoot, set C18 to 1, and check that overshoot is of a satisfactory value during control action. If the value is satisfactory, learning ends as it is.

  If the value is not satisfactory, set C18 to 2, and execute learning by repetitive control.

  Repeat learning until satisfactory results are obtained. When the results of learning are satisfactory, set C18 to 3 to fix the results of learning to end learning.
- C18 is set to 3 when neural network auto-tuning ends.
- Change the SP between the same SPs at all times

  If the SP is changed using a different SP, the learning results obtained so far will be canceled, and learning will resume from the previous learning results.
- This function does not work in the RSP mode.


PV
Overshoot
SP
Time
Set PID constants by AT or manually.
Check whether there is no hunting in usual PID control.
Control with C18 = 1.
When unsatisfactory, execute learning control with C18 = 2.
If hunting is found or control action is abnormal, make readjustment.
Control action by fixing the overshoot suppression strength with C18 = 3.
After the overshoot level becomes a satisfactory value, terminate learning. When there is hunting, make readjustment.
Control action while executing learning.
Change the SP within the same SP at all times

Learning Control Application Concept Diagram

Setup of C19 (independent 2-degrees of freedom PID operation selection)

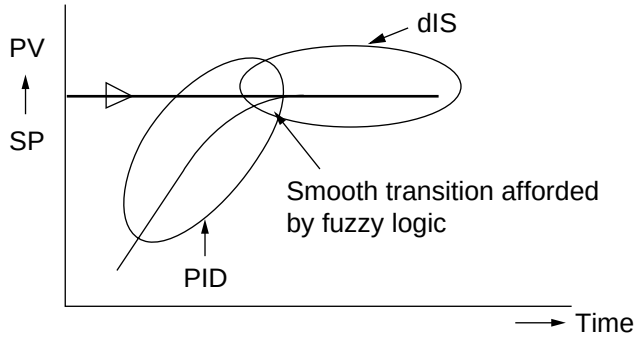
This setup item selects whether or not to use independent 2-degrees of freedom PID that operates based upon fuzzy inference.

0: Not used (normal PID control)

1: Used

Check items

- When independent 2-degrees of freedom PID is used, the ideal PID constant (Pid) for when the set value is changed and the ideal PID constant (dIS) for response to external disturbance can be set independently, and are set switched smoothly by fuzzy inference matched to the control status. When independent 2-degrees of freedom PID is not used, control is carried out using the normal PID constant (PId).



- Both PID constants PId and dIS are automatically set by auto-tuning. They can also be set or changed by the front panel keys or by communications.
- The PId and dIS switching points cannot be set manually.

Setup of C20 (neural network auto-tuning operation selection)

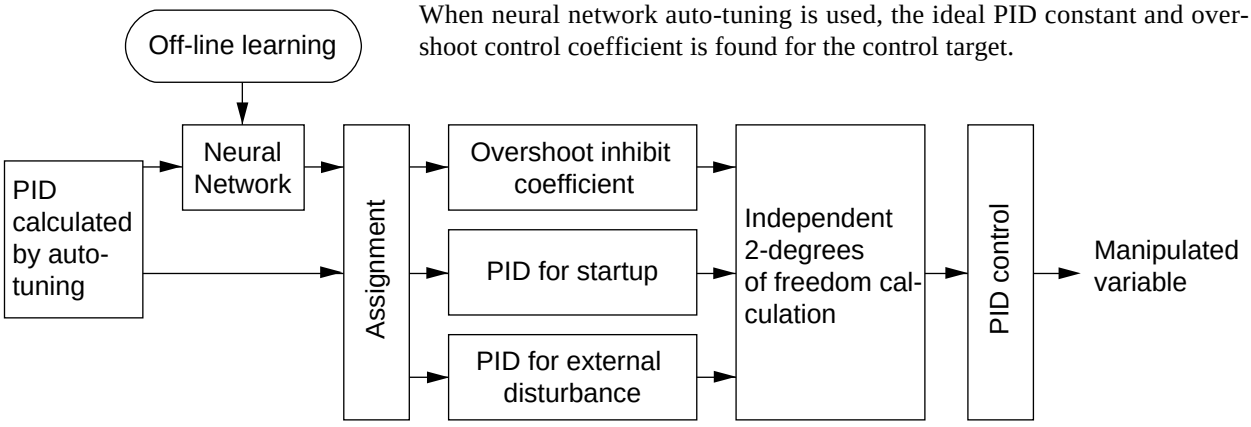
This setup item selects whether or not to use neural network auto-tuning (NNAT).

0: Used

1: Not used (normal auto-tuning)

Check items

When neural network auto-tuning is used, the ideal PID constant and overshoot control coefficient is found for the control target.

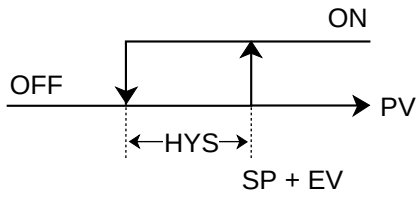
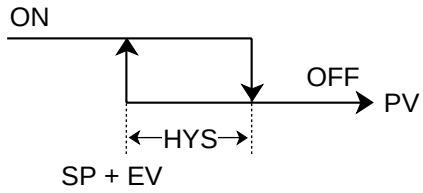
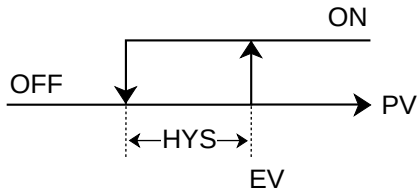
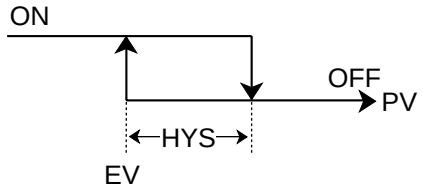
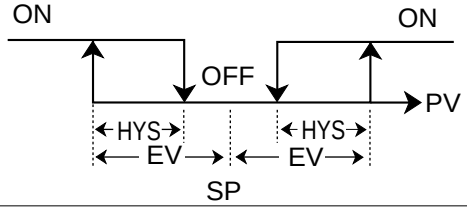
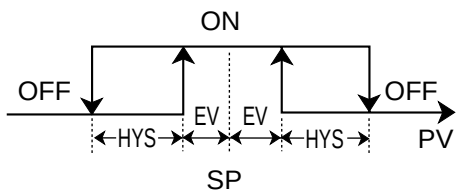


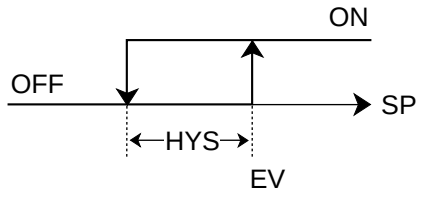
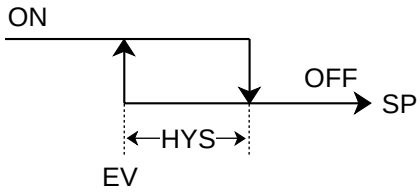
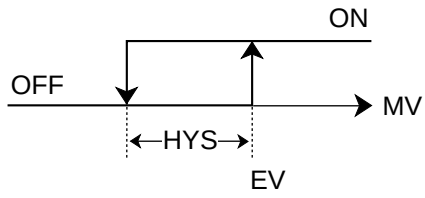
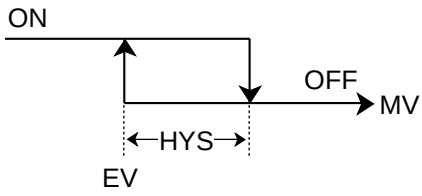
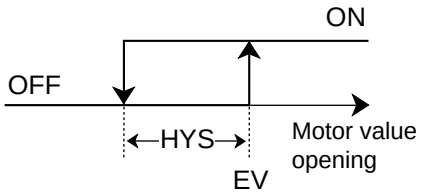
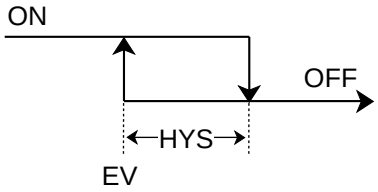
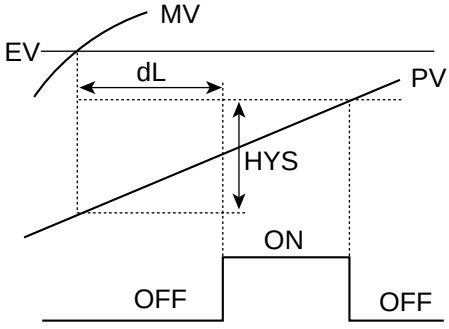
Setup of C21 (event 1 type) and C23 (event 2 type)

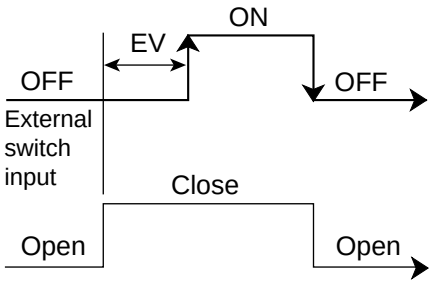
These setups select the type of action of events 1 and 2. To set these setups, set the event codes in the table below.

Event Codes Table

PV: Process value
SP: Setpoint
EV: Event set value
HYS: Hysteresis set value
dL: ON delay time

Code	Types of event	Action	Remarks
0	Event OFF	No event operation	EV, HYS and dL cannot be set.
1	Deviation Direct action		
2	Deviation Reverse action		
3	PV Direct action		
4	PV Reverse action		
5	Absolute value deviation Direct action		
6	Absolute value deviation Reverse action		

Code	Types of event	Action	Remarks
7	SP Direct action		
8	SP Reverse action		
9	MV Direct action		
10	MV Reverse action		
11	Motor feedback Direct action		
12	Motor feedback Reverse action		
13	Control loop diagnosis		If PV does not rise by the hysteresis value or more when the ON delay time has elapsed since the MV exceeds the event setting, the event will be turned ON.

Code	Types of event	Action	Remarks
14	Timer (sec.)		HYS and dL cannot be set.
15	Timer (min)		
16	Alarm Direct action	ON when alarm (AL01, 02, 03, 05, 06, 07) occurs.	EV and HYS cannot be set.
17	Alarm Reverse action	OFF when alarm (AL01, 02, 03, 05, 06, 07) occurs.	EV and HYS cannot be set.
18	Execution at inferred position	ON when motor feedback inferred value is being used	EV, HYS and dL cannot be set.

Setup of C22 (event 1 standby operation selection) and C24 (event 2 standby operation selection)

This setup item selects ON/OFF of the standby sequences of event outputs 1 and 2.

0: Standby OFF

1: Standby ON

Check items

- When “standby ON” is set (excluding timer, alarm, execution at inferred position events, and event OFF), the event output will turn off in the READY mode. When the READY mode changes to the RUN mode, or if the power is turned ON in the RUN mode, the event will not turn on even if the event ON conditions are satisfied, and the event will turn ON after the event OFF conditions are satisfied.
- When “standby ON” is set by the timer event, the timer counter is reset in the READY mode.
- When “standby ON” is set in the alarm or execution at inferred position events, event output is turned off in the READY mode, and the event is turned on if the event ON conditions are satisfied when the READY mode is changed to the RUN mode.
- “Standby ON” can be set even when event is set to OFF. This will pose no particular problems in terms of operation.

Setup of C25 (event operation at READY)

This setup item selects whether to operate the event or to turn the controller OFF without operating the event at READY.

0: Event operation

1: No event operation

Check items

- This setup item functions for both event outputs 1 and 2.
- When "standby ON" set, the event is turned off in the READY mode regardless of the set value of this setup item.
- When "no event operation" is selected in a timer event (standby OFF), the timer counter will stop in the READY mode, and in the RUN mode the count will be started from the value active before the counter was stopped.

Setup of C26 (number of SPs selectable by external switch input)

This setup item sets the number of SPs that can be set by external switch input.

The set ranges of this setup item are restricted by the setting range of C08 as shown in the table below.

C08 Setting	C26 Setting	External Switch Input States			Selected SP
		RSW3	RSW2	RSW1	
0 to 7	0	—	—	—	SP0
1 to 7	2	—	—	OFF	SP0
				ON	SP1
3 to 7	4	—	OFF	OFF	SP0
			OFF	ON	SP1
			ON	OFF	SP2
			ON	ON	SP3
7	8	OFF	OFF	OFF	SP0
		OFF	OFF	ON	SP1
		OFF	ON	OFF	SP2
		OFF	ON	ON	SP3
		ON	OFF	OFF	SP4
		ON	OFF	ON	SP5
		ON	ON	OFF	SP6
		ON	ON	ON	SP7

—: Regardless of SP selection

Check items

- The SP No. can be selected by front panel keys only when set to 0.
- When set to 2, 4 and 8, the status of external switch inputs takes priority, and SP Nos. cannot be selected by front panel keys. However, the SP values in SP banks can be changed at all times.

Setup of C27 (external switch input 1 function), Setup of C28 (external switch input 2 function)

Setup of C29 (external switch input 3 function), Setup of C30 (external switch input 4 function)

This setup item sets the functions of each of the input when the external switch input option is provided.

Setting	Function	During OFF	During ON
0	No operation	—	—
1	RUN/READY switching	RUN	READY
2	AUTO/MANUAL switching	AUTO	MANUAL
3	REMOTE/LOCAL switching	LSP	RSP
4	Start of auto-tuning	Stop	Start
5	Direct/reverse action switching	Operation of C03 setting	Reverse operation of C03 setting
6	Start of timer event (EV1)	Reset	Start
7	Start of timer event (EV2)	Reset	Start

Check items

- This setup item cannot be set to external switch inputs used by the C26 (number of SPs selectable by external switch input) setup item.
- Do not set the same function to two or more external switch input.
- When 1 to 4 are set, the status of external switch inputs takes priority, the mode cannot be switched by the front panel keys and auto-tuning cannot be started or stopped.

Setup of C31 (communication address)

This setup item is used when the communication function is provided as option. Set the communication address from 0 to 127.

Check item

- When 0 is set up, the communications function does not work. There is no response even if the message address from the master station is 0.

Setup of C32 (transmission speed)

This setup item is used when the communication function is provided at option.

0: 9600 bps
1: 4800 bps
2: 2400 bps
3: 1200 bps

Setup of C33 (communication code)

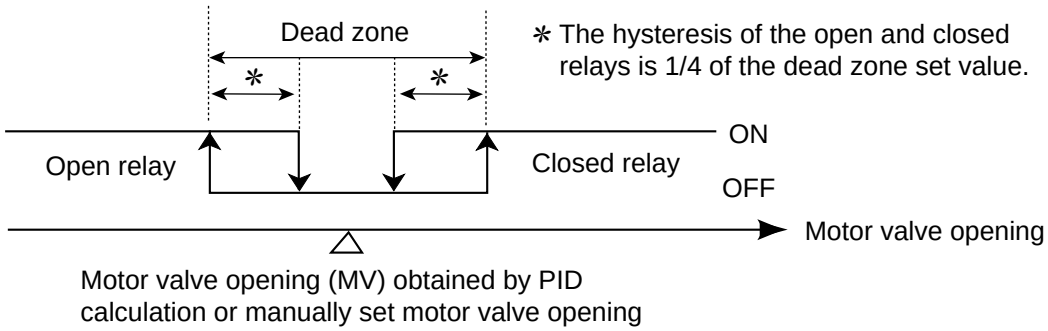
This setup item is used when the communication function is provided at option.

0: 8 bits, even parity, and 1 stop bit
1: 8 bits, non parity, and 2 stop bits

Setup of C34 (dead zone)

This setup item sets the dead zone on 2G (position-proportional) models.

Motor valve opening 0.5 to 25.0%


Dead zone
* The hysteresis of the open and closed relays is 1/4 of the dead zone set value.
*
*
ON
OFF
Open relay
Closed relay
Motor valve opening
Motor valve opening (MV) obtained by PID calculation or manually set motor valve opening

Setup of C35 (modular control motor control method selection)

This setup item selects the control method of modular motor control on 2G (position-proportional) models.

0: MFB control (conventional) + inferred position control

Both the input MFB (Motor Feed Back) value and the internal inferred MFB value are used to achieve smooth motor position control even if the input MFB value is not smooth.

The internal inferred MFB value is sometimes used frequently according to the feedback resistance of the motor that is being used. This is because more accurate position control is being carried out. When the AL07 (T line break) alarm occurs, control automatically shifts over to inferred position control.

1: MFB control (conventional)

The motor is controlled according to the MFB value in the same way as in convention control methods. When the AL07 (T line break) alarm occurs, control automatically shifts over to inferred position control.

2: Inferred position control (MFB OFF)

The motor position is controlled without MFB control.

Check items

- When inferred position control is set, the closed relay turns on at all times when MV is set to 0.0%, and the open relay turns on at all times when MV is set to 100.0%.
- Whichever control method is selected, the modular control motor must be connected and automatically adjusted by C36. However, when “2: inferred position control” is selected, automatic adjustment is no longer required if the time from fully closed to fully open is accurately measured in second units and set to C39.
- By “2: inferred position control,” a deviation sometimes occurs between the MV value and the motor valve opening over prolonged use. This poses no problem in terms of control.

Setup of C36 (modular control motor start of automatic adjustment)

This setup item automatically adjusts deviation in the motor feedback resistance on 2G (position-proportional) models

0: Non-adjusted status

1: Adjustment executed

When "1" is set and ENT key is pressed, the motor valve opening in the fully open and closed states, and the time from fully open to fully closed is automatically adjusted.

① The motor operates towards the closed side (PV display: CA.CL).

② When the motor is fully closed, the motor operates towards the open side. (PV display: CA.oP)

③ When the motor is fully open, adjustment ends after the motor valve opening is monitored for several seconds.

Check items

- If the measurement results are in error, "AL08" is indicated. "AL08" goes out when the power is turned ON again or when correct adjustment is carried out.

  "AL08" occurs in the following instances:

  Within 5 seconds from the fully closed to the fully open time

  When the fully closed count value ≥ fully open count value

- Adjustments are not possible in the MANUAL mode.
- When the DISP key is pressed during adjustment, adjustment is canceled, and the display returns to the basic indication status. Input by any key other than DISP is not accepted.
- When using a new motor, be sure to carry out this adjustment with the motor actually in use. When adjustment is carried out in a state that differs from the actual state (e.g. the valve is not fitted), an error may occur in the inferred position due to a different in the load placed on the motor.
- Hunting may occur during a single adjustment operation as a result of the motor characteristics or instrumentation state.

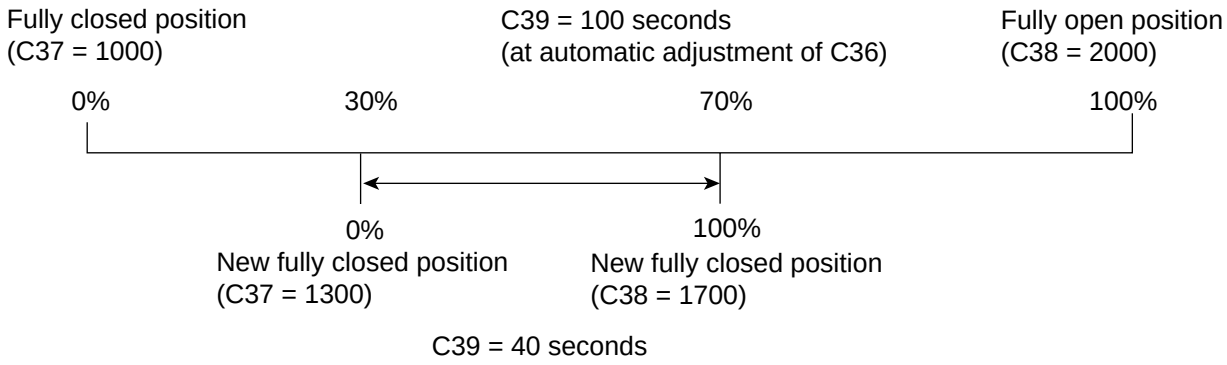
  In this instance, carry out the adjustment again.

Setup of C37 (modular control motor fully closed adjusted value)

Setup of C38 (modular control motor fully open adjusted value)

These setup items set the fully closed and fully open adjusted values when you want to use the valve opening position at the fully closed and open positions of the modular control motor at narrower settings than the current positions.

The following example shows how the new fully closed and open positions are set to a position 30 to 70% of the original fully closed and open positions after automatic adjustment by setup item C36.



New fully closed position (C37) = (original C37) + {(original C38) - (original C37)} x 30%
= 1000 + (2000 - 1000) x 0.3
= 1300

New fully closed position (C38) = (original C37) + {(original C38) - (original C37)} x 70%
= 1000 + (2000 - 1000) x 0.7
= 1700

New fully closed/open time (C39) = 100 x (0.7- 0.3)
= 40 (sec.)

Check items

- The motor cannot be actually operated to set the desired fully closed and open adjusted values.
- When this setup item is set, C39 (fully open/closed time) is automatically re-adjusted by calculating proportionately fro the adjusted value obtained by automatic adjustment.
- When C35 is set to 0 or 2, the value of this setup item cannot be confirmed or set.

Setup of C39 (modular control motor fully open/closed time)

This setup item sets the time from fully closed to fully open in seconds on 2G (position-proportional) models.

5 to 240 sec.

Check items

- When C35 is set to 0 or 1, C39 is automatically set when automatic adjustment is carried out C36.
- When C35 is set to 1, C39 is automatically reset when the value of C37 or C38 is changed.
- When C35 is set to 0, the value of this setup item cannot be confirmed or set.

Setup of C40 (SP ramp up gradient), Setup of C41 (SP ramp down gradient)

This setup item sets the SP value rate-of-change per second unit that is set by C42.

0 to 9999

Check items

- The SP value before it was changed is taken as the start point in the following instances:

  When the SP value was changed in the single SP mode

  When the SP group was selected and changed in the multi SP mode

  When the currently executing SP value was changed during in the multi SP mode

  When the RSP mode changed to the RUN mode

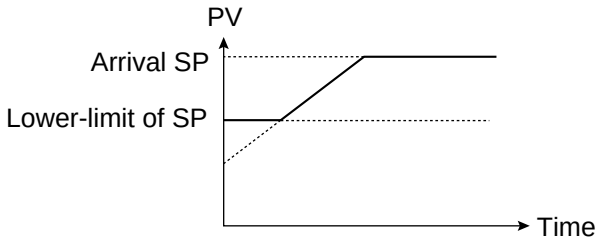
- The PV value is taken as the start point in the following instances:

  The PV value that is first displayed by the controller when the power is turned ON

  When the READY mode changed to the RUN mode

  When the MANUAL mode is changed to the AUTO mode

- Generally, SP ramp operates with the SP limit ignored. However, the SP limit is enabled when the SP value is outside of the SP limit as a result of the RSP value when the RSP mode changes to the LSP mode, and the SP value in fact does not change until the SP value falls back inside the SP limit range. However, SP ramp starts from the SP limit value when the AL05 or AL06 errors occur.



- If this setup item is changed while SP ramp is executing, SP ramp up and down will continue according to the changed value.
- SP ramp does not function in the RSP mode, or when the LSP mode is changed to the RSP mode.
- When auto-tuning is carried out while SP ramp is executing, the SP value at that time is set as the SP value for auto-tuning, and SP ramp up and down continues internally even while auto-tuning is being carried out.

Setup of C42 (SP ramp time unit selection)

This setup item selects the time unit of SP ramp up or down gradient.

0: Unit/minute

1: 0.1 unit/minute

2: Unit/hour

3: 0.1 unit/hour

Setup of C43 (green belt)

This setup item sets the green belt range. When the absolute value of the deviation comes within the range set up by this item (|PV-SP| ≤C43 set value), the green belt will light.

0 to (PV range)/2

C44 (auxiliary output type)

This setup item selects the signal source of auxiliary output.

0: PV	PV value
1: SP	SP value currently being used for control calculations
2: Pre-bias RSP	RSP value to which the rbIA set value has not been added
3: RSP	RSP value to which the rbIA set value has been added
4: MV	MV value
5: Motor valve opening	% value of the motor valve opening (fully closed: 0.0%, fully open: 100.0%)

Check items

- When the RSP or pre-bias RSP is selected, the RSP value is output with the SP limit ignored.

Setup of C45 (value of signal source at 4 mA auxiliary output)

This setup item sets the value of the signal source selected by C44 by which the output current becomes 4 mA.

-1999 to 9999	Setting range when C44 is set to 0, 1, 2, 3
-199.9 to 999.9	Setting range when C44 is set to 4, 5

Check items

- When C44 is set to 0, 1, 2, or 3, the decimal point position is dependent on the set value of C05.
- A value greater than the C46 set value can be set.

Setup of C46 (value of signal source at 20 mA auxiliary output)

This setup item sets the value of the signal source selected by C44 by which the output current becomes 20 mA.

-1999 to 9999	Setting range when C44 is set to 0, 1, 2, 3
-199.9 to 999.9	Setting range when C44 is set to 4, 5

Check items

- When C44 is set to 0, 1, 2, or 3, the decimal point position is dependent on the set value of C05.
- A value greater than the C45 set value can be set.

Setup of C47 (RSP value at 0% input)

This setup item sets the RSP value when the input signal of the remote setting input (RSP) is 4 mA (or 1 V).

-1999 to 9999

Check items

- The decimal point position is dependent on the set value of C05.
- A value greater than the C48 set value can be set.

Setup of C48 (RSP value at 100% input)

This setup item sets the RSP value when the input signal of the remote setting input (RSP) is 20 mA (or 5 V).

-1999 to 9999

Check items

- The decimal point position is dependent on the set value of C05.
- A value greater than the C47 set value can be set.

Setup of C49 (cold junction compensation operation selection)

This setup item selects whether or not to carry out cold junction compensation in the case of thermocouple input.

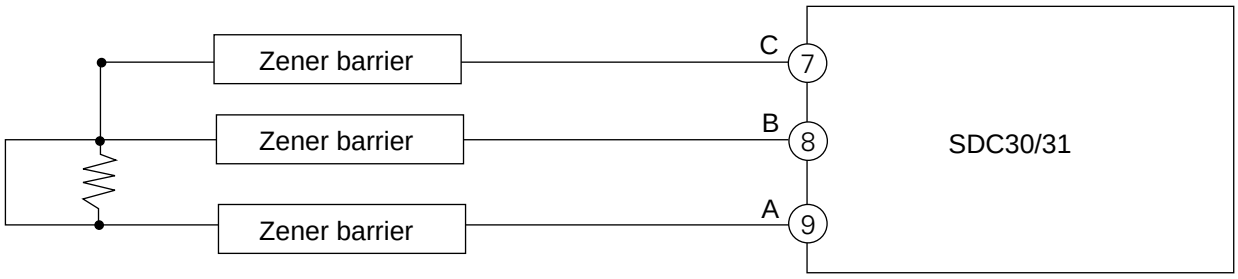
0: ON

1: OFF

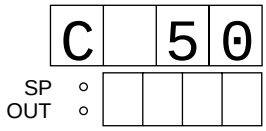
Setup of C50 (Zener barrier adjustment)

This controller must be adjusted to correct a dispersion of the resistance value of Zener barriers on models having an additional Zener barrier processing function with a resistance thermometer.

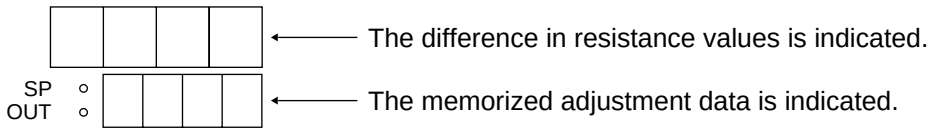
1. When you have finishing mounting and wiring the controller, short A to B on both ends of the resistance thermometer.



2. Turn the SDC/31 ON. Setup parameter C50 will be indicated on the No.1 indicator (upper indicator).



3 . Press the (ENT) key. The difference (A-B) between the resistance values of the Zener barriers connected to the A and B lines will be displayed on the No.1 indicator. The adjusted data stored to the controller will be displayed on the No.1 indicator (lower indicator).



4. Press the (ENT) key to store the adjusted value to the SDC/31.
5. Remove the short-circuit across the A and B lines.
6. Press the (DISP) key to set the indicator to the basic indication status.

! HANDLING PRECAUTIONS

- The resistance difference between the Zener diodes connected to A and B lines should be less than 20 Ω. Otherwise, adjustment is not possible.
- Use a Zener barrier having a resistance of 70 Ω or less.
- This adjustment is not necessary if the instrument is used with an input other than a resistance thermometer input.
- If a Zener barrier is not used, this adjustment is not necessary even if the instrument is used with resistance thermometer input.
- Once the Zener barrier has been adjusted, the adjusted value for the Zener barrier is stored to memory. The controller cannot be used from then on without the Zener barrier connected or in combination with another Zener barrier. In such a case, the above adjustment must be carried out again.

Setup of C51 (adjustment code)

This setup item is to be used for adjustments and inspections only. Do not change the factory setting of this setup item.

Setup Parameters Table

Item	Indication	Setting condition	Default	Setting range	Remarks
Key lock	C 01	—	0	0: No key lock 1: Key lock 1 2: Key lock 2 3: Key lock 3	For details on key lock, see page 4-6.
Temperature unit	C 02	T/C or RTD	0	0: °C 1: °F	
Control action	C 03	—	0	0: Reverse action 1: Direct action	
PV input range	C 04	—		See Input Range Table, page 4-7.	
Decimal point position	C 05	See C05 setting (decimal point position), page 4-7.	0	T/C, RTD: 0 to 1 decimal digit Linear: 0 to 3 decimal digits	
Lower-limit of PV input range	C 06	—	0	(selected range lower-limit) to C07	In case of linear input, scaling is possible in range -1999 to 9999.
Upper-limit of PV input range	C 07	—	1000	C06 to (selected range upper-limit)	
SP setting system	C 08	—	0	0: Single SP 1 to 7: Multi-SP	
Lower-limit of SP	C 09	—	Range lower-limit	C06 to C07	
Upper-limit of SP	C 10	—	Range high-limit	C09 to C07	
Selection of output in case of PV abnormal	C 11	—	0	0: Output PID calculation results 1: Closed relay ON (C35=2) C12 setting (other than above) 2: Closed relay ON (C35=2)	
Control output at READY and PV abnormal	C 12	—	0%	0D, 6D, 2G: 0 to 100% 5G: -10 to +110%	Valid at READY or when C11=1 and abnormal PV
Manual initial control output selection	C 13	—	0	0: Bump-less 1: Preset	Always bump-less when C35=2 Initial control output when mode is changed to AUTO from MANUAL

Item	Indication	Setting condition	Default	Setting range	Remarks
Preset manual value	C14	—	0%	0D, 6D, 2G: 0 to 100% 5G: -10 to +110%	C14 value is output regardless of C13 when the power is turned ON again in the MANUAL mode. This setting is invalid when C35=2.
Initial manipulated variable in PID operation	C15	—	0%	0 to 100%	
PID operation initialize	C16	—	0	0: AUTO 1: Initialize at SP change or RSP/LSP switching 2: Do not initialize	
Zone PID operation	C17	—	0	0: OFF 1: ON	
Control system selection	C18	C20=1	0	0: Normal PID control 1: Overshoot relaxation 2: Learning function status 3: Fixed learning status	C18 is automatically set to 3 when auto-tuning ends when C20=2
Independent 2-degrees of freedom PID operation selection	C19	—	0	0: Not used 1: Used	
Neural network auto-tuning operation selection	C20	—	0	0: Used 1: Not used	This setting is valid when set before execution of auto-tuning.
Event 1 type	C21	With event 1	0	0: Event OFF 1: Deviation (direct action) 2: Deviation (reverse action) 3: PV (direct action) 4: PV (reverse action) 5: Absolute value deviation (direct action) 6: Absolute value deviation (reverse action) 7: SP (direct action) 8: SP (reverse action) 9: MV (direct action) 10: MV (reverse action) 11: Motor feedback (direct action) 12: Motor feedback (reverse action) 13: Control loop diagnosis 14: Timer (sec.) 15: Timer (min) 16: Alarm (direct action) 17: Alarm (reverse action) 18: Execution at inferred position	
Event 1 standby operation selection	C22	With event 1	0	0: Standby OFF 1: Standby ON	
Event 2 type	C23	With event 2	0	Same as C21	

Item	Indication	Setting condition	Default	Setting range	Remarks
Event 2 standby operation selection	C24	With event 2	0	0: Standby OFF 1: Standby ON	
Event operation at READY	C25	With event	0	0: ON 1: OFF	
Number of SPs selectable by external switch input	C26	With RSW input	0	0, 2, 4, 8	Restricted by setting of C8
External switch input 1 function	C27	With RSW1	0	At OFF/at ON 0: No operation 1: RUN/READY 2: AUTO/MANUAL 3: LSP/RSP 4: STOP/START (auto-tuning) 5: PID direct/reverse 6: Reset/start (timer EV1) 7: Reset/start (timer EV2)	PID direct/reverse is reverse of C03 setting when RSW is ON.
External switch input 2 function	C28	With RSW2	0		
External switch input 3 function	C29	With RSW3	0		
External switch input 4 function	C30	With RSW4	0		
Communication address	C31	With communication function	0	0 to 127	0: No response
Transmission speed	C32	With communication function	0	0: 9600 bps 2: 2400 bps 1: 4800 bps 3: 1200 bps	
Communication code	C33	With communication function	0	0: 8 bits, even parity, 1 stop bit 1: 8 bits, no parity, 2 stop bits	
Dead zone	C34	2G output	10.0%	0.5 to 25.0%	
Modular control motor control method selection	C35	2G output	0	0: MFB+inference 1: MFB 2: Inference	
Modular control motor start of automatic adjustment	C36	2G output	0	0: Non-adjusted state 1: Adjustment executed	Adjusted value is automatically set to C37, C38 and C39.
Modular control motor fully closed adjusted value	C37	2G output C35=1	1000	0 to 9999	Input is possible in range that satisfies condition C37<C38.
Modular control motor fully open adjusted value	C38	2G output C35=1	3000	0 to 9999	
Modular control motor fully open/closed time	C39	2G output C35=1, 2	30 sec.	5 to 240 sec.	Manually set when C35=2

Item	Indication	Setting condition	Default	Setting range	Remarks
SP ramp up gradient	C40	—	0	0 to 9999 unit (0.1 unit)/min (hr)	No gradient at 0 Valid only for LSP
SP ramp down gradient	C41	—	0		
SP ramp time unit selection	C42	—	0	0: Unit/min 1: 0.1 unit/min 2: Unit/hr 3: 0.1 unit/hr	
Green belt	C43	—	5	0 to 1/2 PV range	Lights at |PV-SP| ≤C43 condition
Auxiliary output type	C44	With auxiliary output	0	0: PV 1: SP 2: Pre-bias RSP 3: RSP 4: MV 5: Motor valve opening	PID calculation result is output when MV is selected on 2G output.
Value of signal source at 4 mA auxiliary output	C45	With auxiliary output	0 unit OR 0.0%	C44=0, 1, 2, 3 -1999 to +9999 unit C44=4, 5 -199.9 to +999.9 unit	Decimal point is dependent on C05 when C44=0, 1, 2, 3.
Value of signal source at 20 mA auxiliary output	C46	With auxiliary output	1000 unit OR 100.0R	C44=0, 1, 2, 3 -1999 to +9999 unit C44=4, 5 -199.9 to +999.9 unit	Decimal point is dependent on C05 when C44=0, 1, 2, 3.
RSP value at 0% input (4 mA, 1 V)	C47	With remote setting input	0 unit	-1999 to +9999 unit	Decimal point is dependent on C05.
RSP value at 100% input (20 mA, 5 V)	C48	With remote setting input	1000 unit	-1999 to +9999 unit	
Cold junction compensation operation selection	C49		0	0: ON 1: OFF	
Zener barrier adjustment	C50	Zener barrier model C04=RTD range	0	-20.00 to +20.00	
Adjustment code	C51	—	0		Do not change this factory setting.

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Chapter 5 SETTING OF PARAMETERS

5-1 Parameters Table

The following parametes are provided.

Parameters Table

BANK	Item	Indication	Setting condition	Default	Setting range	Remarks
SP	Set point 0 to 7	SP 0 to SP 7	C8≥1	0	Within SP lower- and upper-limit (C9, C10)	(Note 1)
PId0 (Note 2)	Proportional band	P	—	5.0%	0.0 to 999.9% 0.1 to 999.9%	ON/OFF control when 0.0 is set. 0.0 cannot be set on 2G and 5G models.
	Integral time	I	p≠0	120 s	0 to 3600 s	
	Derivative time	d	P≠0	30 s	0 to 1200 s	
	Lower-limit of manipulated variable	oL	P≠0	0%	0 to upper-limit %	Doubles as the lower- and upper-limits of the integral limitter.
	Upper-limit of manipulated variable	oH	P≠0	100%	Lower-limit to 100%	
	Manual reset	rE	I=0 & P≠0	50%	0 to 100%	
	Differential	dIFF	P=0	5 unit	0 to 100 unit	
PIdx (Note 2)	PId 1 to 7, r	P to dIF is followed by No. (1 to 7) or r.	(Note 3) PIdr is not displayed in case C17=1.	Same as P to dIF		
dI50 External distur-bance inhibit PID (Note 4)	Proportional band	dP	—	5.0%	0.0 to 999.9% 0.1 to 999.9%	ON/OFF control when 0.0 is set. 0.0 cannot be set on 2G and 5G models.
	Integral time	dI	P≠0	120 s	0 to 3600 s	
	Derivative time	dd	P≠0	30 s	0 to 1200 s	
dI5x	dI5 1 to 7, r	dP to dd is followed by No. (1 to 7) or r.		Same as P to dIF		

C'ntd on next page

Parameters Table (cont'd)

BANK	Item	Indication	Setting condition	Default	Setting range	Remarks
PArA	EV1 hysteresis	HYS1	EV1 is provided C21=1 to 13	5 unit	0 to 100 unit	
	EV1 ON delay time	dL 1	EV1 is provided C21=1 to 13	0 s	0 to 9999 s	
	EV2 hysteresis	HYS2	EV2 is provided	5 unit		
	EV2 ON delay time	dL 2	EV2 is provided C23=1 to 13	0 s		
	PV filter	FILt	—	0.0 s	0.0 to 25.0 s	
	PV bias	Pbi A	—	0 unit	±1000 unit	
	RSP bias	rbi A	Remote setting input is provided	0 unit	-1999 to +9999 unit	
	Time-proportional cycle	CYCL	Time-proportional output	10 s	5 to 120 s: relay 1 to 120 s: voltage	
	MC rate-of-change limit	outL	—	100.0 %	0.1 to 100.0%	
Zone	ZONE setting	Zn x (x=1 to 7)	C17=1	100.0 %	0.0 to 100.0%	Though Zn0 is not displayed, it is 0.0%.

Note 1: This is not indicated in the case of single SP.

Note 2: This is indicated until the set that is preset by C08. Note that this is indicated within the range 0 to 7 when zone PID is used (C17=1).

Note 3 : PIdr is indicated when the remote setting input is provided and zone PID is not used (C17=0).

Note 4: This is indicated when independent 2 degrees of freedom PID is used (C19=1).

PISr is indicated when the remote setting input is provided and zone PID is not used (C17=0).

5-2 Basic Parameter Operation

The following describes basic parameter operation.

① In the basic indication status, simultaneously hold down the ENT and ▲ keys for three seconds to display the bank indication status.

② Press the ▲ or ▼ key to select the bank containing the desired parameter.

③ Press the ENT key to display the parameter indication status.

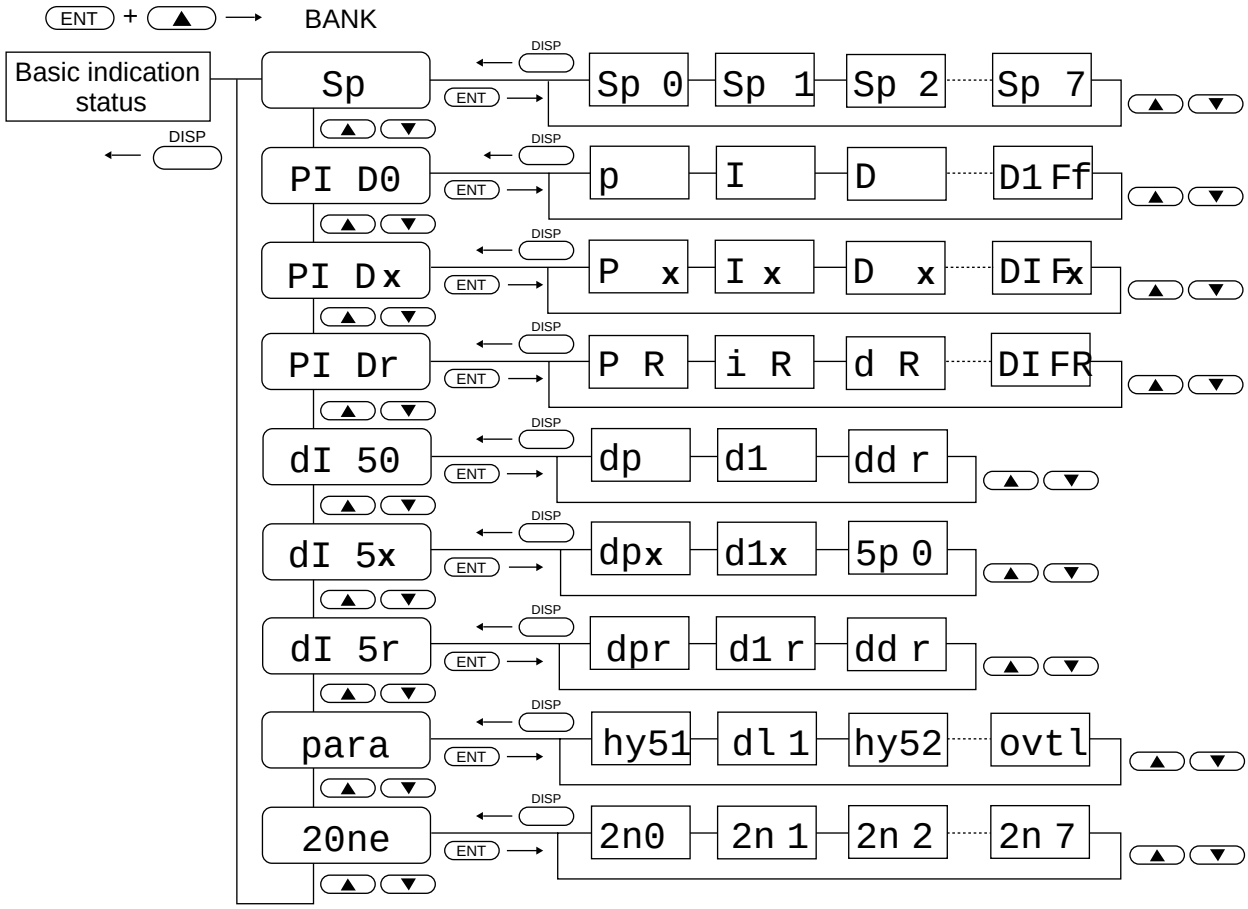
④ Press the ▲ or ▼ key to select the desired parameter.

⑤ Press the ENT key to set to the substitution status.

⑥ Press the ▲ or ▼ key to set the desired value.

⑦ Press the ENT key to store the value that you have set to memory.

⑧ Press the DISP key to display the basic indication status. Pressing the DISP key only once displays the bank indication status.



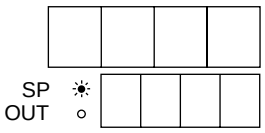
5-3 Setting Parameters & Parameter Display Examples

The following describes examples of how to set parameters.

Operation Procedure The procedure for changing the set value of the proportional band (P) is shown below.

① To set to the basic indication status

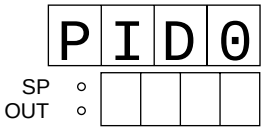
Press the DISP key.



← A PV value at this time is indicated.
← An SP value, MV value or motor valve opening is indicated.

② To indicate the bank

Continue pressing the ENT and ▲ keys simultaneously for 3 seconds.

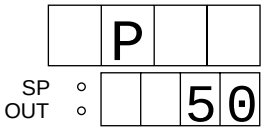


← PIdo is indicated flashing.
← Nothing is indicated.

Note) SP is indicated in the case of multi-SP, so press the ▼ key To indicate PId0.

③ To indication parameters

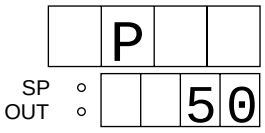
Press the ENT key.



← P is indicated.
← The set value of that item is indicated.

④ To assign the parameter

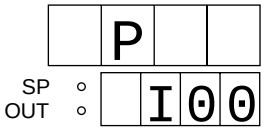
Press the ENT key.



← Changes to flashing (not defined).

⑤ To change the set value

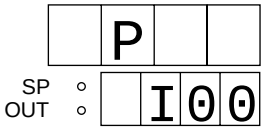
Change the numeric, using the ▲ key or the ▼ key.



← Keeps flashing.

⑥ To define the changed numeric

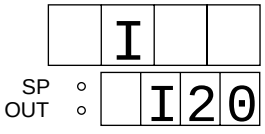
Press the ENT key.
→ Flashing stops and the set value is defined.



← Does not flash.

⑦ To transfer to the next parameter

Make sure that numeric is not flashing, and press the ▼ key. To return to the previous parameter, press the ▲ key.



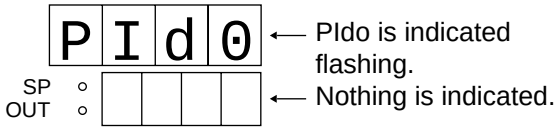
← I is indicated at this time.
← The set value of that item is indicated.

To next page

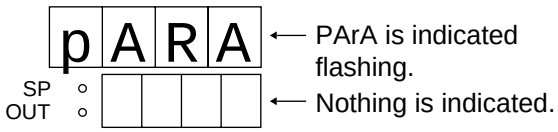
⑧ To change the numeric
Repeat steps
④→⑤→⑥

Not to change the numeric
Carry out step ⑦.

⑨ To indicate the bank — Press the DISP key.

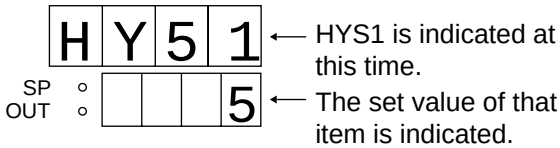


⑩ To move to another bank — Press the ▼ key.



Note) To return to the previous bank, press the ▲ key.
To advance to the next bank, press the ▼ key.

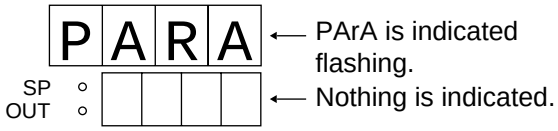
⑪ To indicate parameters — Press the ENT key.



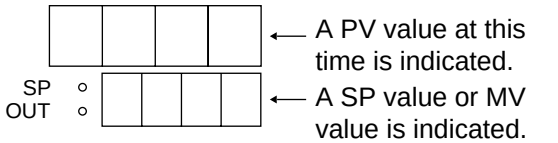
⑫ To change the numeric
Repeat steps
④→⑤→⑥

Not to change the numeric
Carry out step ⑦.

⑬ To indicate the bank — Press the DISP key.



⑭ To set to the basic indication status — Press the DISP key.



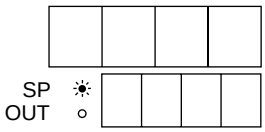
5-4 Assigning a Parameter to the (SP/EV UF) Key

This instrument can assign parameters, which are often used during operation, to the (SP/EV UF) key, and call them as required, using the (SP/EV UF) key only.

Operation Procedure The procedure for assigning the proportional band (P) to the (SP/EV UF) key is shown below.

① To set to the basic indication status.

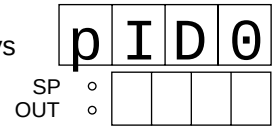
Press the (DISP) key.



← PV value or Fb at that time is indicated.
← SP value, MV value or motor valve opening is indicated.

② To indicate the bank

Continuously, press the (ENT) key and (▲) keys simultaneously for 3 seconds.

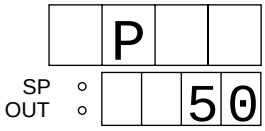


← PIdo is indicated flashing.
← Nothing is indicated.

Note) SP is indicated in the case of multi-SP, so press the (▼) key To indicate PId0.

③ To indicate a parameter to be assigned.

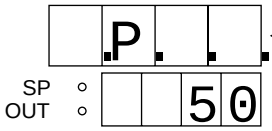
Press the (ENT) key.



← P is indicated.
← The set value of that item is indicated.

④ To assign the parameter

Press the (▲) key, while pressing the (MODE) key.
Four decimal points are indicated below the parameter in the No.1 indicator.

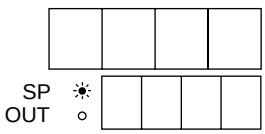


← Example of indication when registering the proportional band.

⑤ To transfer to the next parameter to be assigned.
Press the (▼) key.
Repeat step ④.

⑥ To set to the basic indication status.

Press the (DISP) key twice.



← A PV numeric is indicated.
← An SP numeric is indicated.

Check items

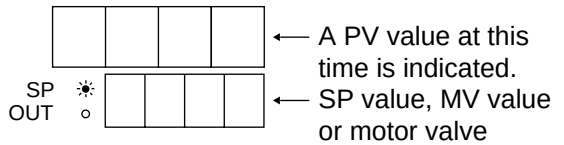
If 9 or more parameters are attempted to be assigned, the parameter(s) assigned at first is reset, and the new parameter(s) is assigned.

5-5 Resetting a Parameter Assigned to the (SP/EV UF) Key

Operation Procedure The procedure for resetting the proportional band (P) assigned to the (SP/EV UF) key is shown below.

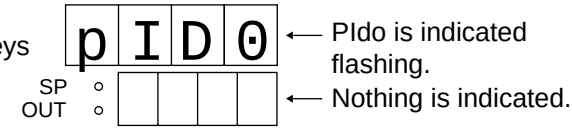
① To set to the basic indication status

Press the (DISP) key.



② To indicate the bank

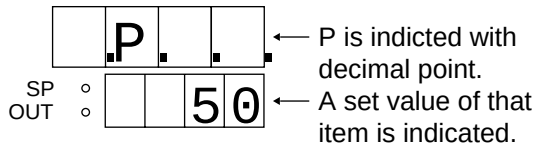
Continue pressing the (ENT) key and (▲) keys simultaneously for 3 seconds.



Note) SP is indicated in the case of multi-SP, so press the (▼) key To indicate PId0.

③ To indicate a parameter to be reset

Press the (▼) key.

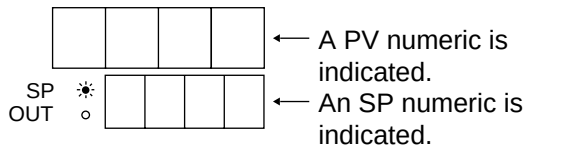


④ To reset the parameter assigned.

Press the (▼) key, while pressing the (MODE) key.
The decimal points in No.1 indicator go out.

⑤ To set to the basic indication status

Press the (DISP) key twice.



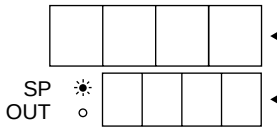
5-6 Operation of Parameters Assigned

The set values of parameters assigned to the SP/EV UF key can be checked or changed by one touch operation.

Operation Procedure The procedure for changing the proportional band (P) assigned to the SP/EV UF key from 5.0% to 10.0% is shown below.

① To set to the basic indication status

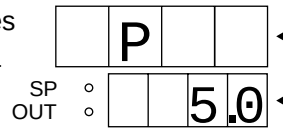
Press the DISP key.



← PV value or Fb at that time is indicated.
← SP value, MV value or motor valve opening is indicated.

② To indicate parameters

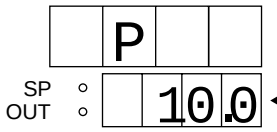
Press SP/EV UF several times To indicate P on the No.1 indicator.



← The type of parameter is indicated.
← The set value of that item flashes.

③ To change the set value (jump to step ⑤ when not to be changed)

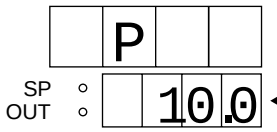
Change the numeric, using the ▲ key or ▼ key.



← Keeps flashing. (10.0% setting)

④ To define the changed numeric

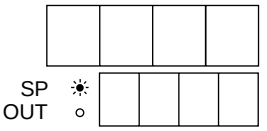
Press the ENT key.
→ Flashing stops and the set value is defined.



← Does not flash.

⑤ To set to the basic indication status

Press the DISP key.



← A PV numeric is indicated.
← An SP numeric is indicated.

Check items

The parameters are indicated in the order of assignment.

5-7 Description on Parameters

Set point (SP0 to SP7)

When multi SP is selected in the setup item C08 (SP setting system), eight groups of SPs are prepared matched to the preset value (1 to 7).

PID constants

When multi SP is selected in the setup item C08 (SP setting system), eight groups of PID constants are prepared matched to the preset value (1 to 7). Controller models on which RSP has been added are provided with PID groups specifically for RSP.

P,I, D correspond to SP0, while P7, I7, D7 correspond to SP7. Pr, Ir, Dr correspond to RSP.

SP 0	PI D0	DI 50
SP 1	PI D1	DI 51
⋮	⋮	⋮
SP 7	PI D7	DI 57
RSP	PI Dr	DI 5r

Determine P=Proportional band, I=Integral time and D-Derivative time.

When setting I to 0, the integral action turns off so that the manual reset can be set.

When setting P to 0.0, the on-off action is selected, and the differential can be set.

However, P=0 cannot be set on model 5G (current output) and 2G (position-proportional).

Check items

- When setting P to other than 0.0, the differential cannot be set.
- When setting I to other than 0, the manual reset cannot be set.

Upper and lower limits of manipulated variable (oH, oL)

These parameters oH and oL determine the upper and lower limits of the manipulated variable.

They also serve as the upper and lower limits of the integral limiter.

When no feedback (C35=2) is selected in the set up item C35 (modular motor control selection) on a 2G model, the manipulated variable becomes 0 to 100% regardless of this setting.

Check items

The setting ranges of oL and oH are 0 to oH and oL to 100, respectively.

Manual reset (rE)

This is used for manually obtaining a control deviation when the integral is turned off.

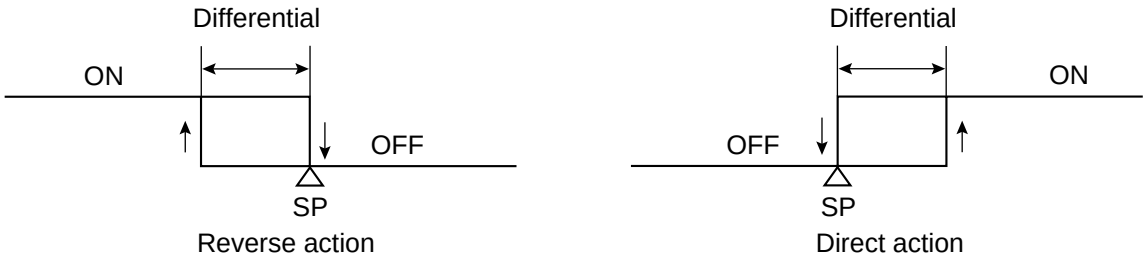
This can be done when I=0 and P≠0.0.

Differential (dIFF)

This parameters can set a difference between the on point and the off point (differential, dead band) in on-off action.

When P=0.0, the on-off action is then ready to set the differential.

However, P=0 cannot be set on model 5G (current output) and 2G (position-proportional).



External disturbance inhibit PID constants

When use of the external disturbance inhibit PID constants is selected in the setup item C19, up to eight groups of external disturbance inhibit PID constants (proportional band, integral time, derivative time) are indicated matched to the set value of setup item C08 (SP setting system) in addition to the regular PID constant group. These eight groups can be selected. Controller models on which RSP has been added are provided with external disturbance inhibit PID groups specifically for RSP.

For details, see PID constant (page 5-9).

Check items

① External disturbance inhibit PID constants are set automatically by auto-tuning.

② If both or one of the proportional band for external disturbance inhibit or regular proportional band is 0, the external disturbance inhibit function will not operate, and on-off action is selected.

③ If both or one of the integral time for external disturbance inhibit or regular integral time is 0, the external disturbance inhibit function will not operate, and control will use the manual reset preset to the regular PID group.

Event hysteresis (HYS1, HYS2), event ON delay time (dL1, dL2)

These parameters can set a difference between the event on and off points (hysteresis dead band).

To set an event on when the event is continuous when conditions for turning the event on are set to the event ON delay time, set the desired values to these parameters.

Event Type	Timer	Alarm	Defining Position being Executed	Event OFF	Other
Hysteresis	X	X	X	X	○
ON delay time	X	○	X	X	○

○: Can be set, X: Cannot be set

The event relay turns on if the PV value does not rise above the differential set value (does not fall below the differential set value in the case of direct action) even after the on delay time when a manipulated variable greater than the event set value is being output by the control loop diagnosis event.

PV filter (FILt)

This parameter can set T in the following equation.

$$Y(n) = (1- \frac{0.2}{0.2+T}) \times Y(n-1) + \frac{0.2}{0.2+T} Y$$

Y(n): PV value after passing through the filter

Y(n-1): Previous PV value that passed through the filter

Y: PV value before passing through the filter

PV bias (PbIA)

The PV value is indicated and controlled using the PV value obtained by adding the PV bias set value to the regular PV value.

Judgment of over-range (AL01) and under-range (AL02) is carried out on the PV value to which bias is added.

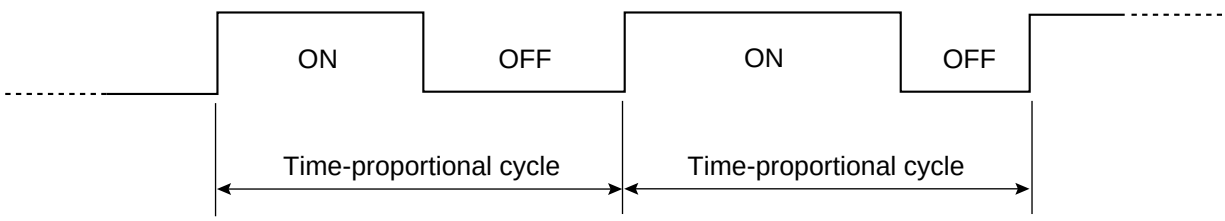
RSP bias (rbIA)

The RSP value is indicated and controlled using the value obtained by adding the RSP bias set value to the regular remote setting input (RSP) value.

Judgment of over-range (AL05) and under-range (AL06) is carried out on the RSP value before bias is added.

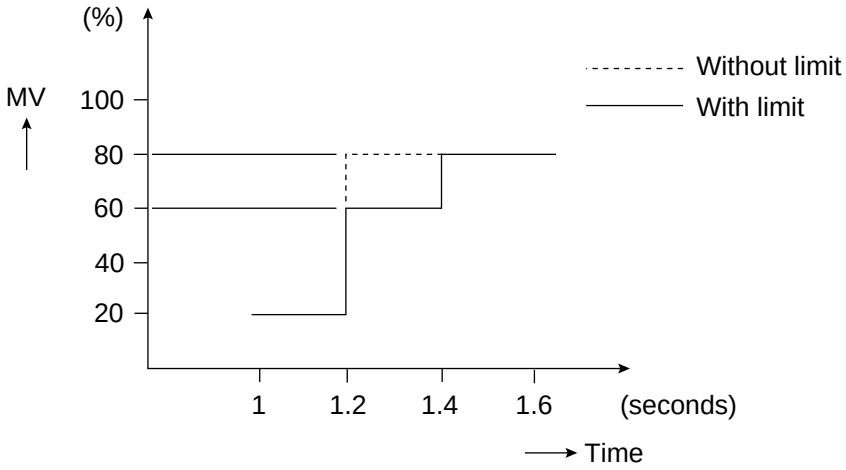
Time-proportional cycle (CyCL)

In the case of time-proportional output, the ratio between on and off is determined by control calculation taking a certain period of time as the basic time unit. The time that forms the “basic time unit” is the cycle time.



Manipulated variable rate-of-change limit (outL)

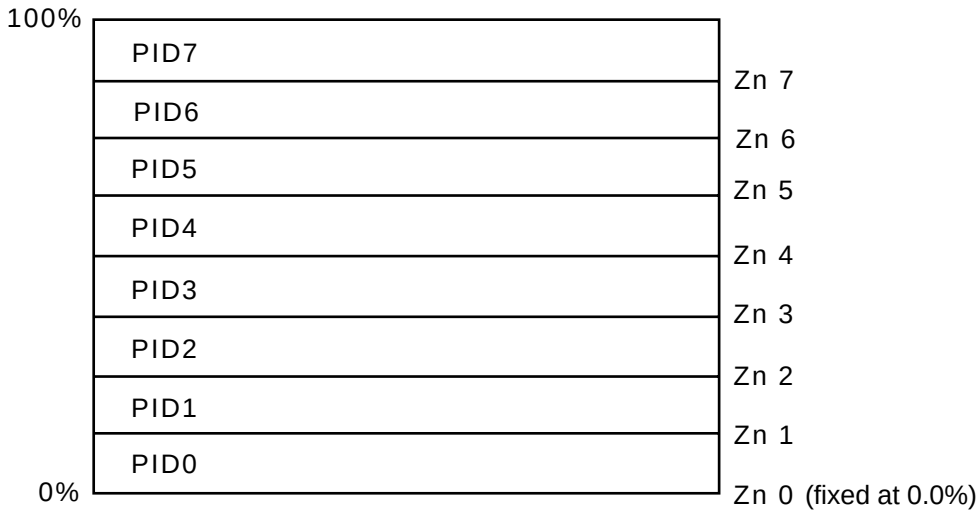
In addition to PID operation, the rate-of-change of the manipulated variable at each output update cycle (0.2 seconds) can be limited. The example below shows how the manipulated variable actually changes when the manipulated variable changes from 20% to 80% with the manipulated variable rate-of-change limit set to 40%.



Zone setting (Zn 1 to Zn 7)

When use of zone PID operation selection is selected in the setup item C17, the PID group is automatically switched according to the range of the currently executing SP value.

This setup determines in which SP range (zone) the PID groups should operate. Set the PV range width to 0 to 100%, and the SP zone as follows.



Check items

- Set the zone setting as Zn 0 ≤Zn 1≤ .... and so forth to ≤ Zn 7. nE 0 is fixed at 0.0%.
- Zone PID functions in either of the LSP, RSP and SP ramps.

- In the above figure:

  PID0: 0.0 ≤ SP< (set value of Zn 1)

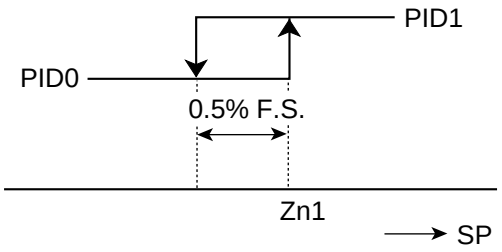
  PID1: (set value of Zn 1) ≤ SP < (set value of Zn 2)

  :

  PID7: (set value of Zn 7) ≤ SP

- The difference between PID constant group switching points is 0.5% FS.

  Example: Switching point between PID0 and PID1



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Chapter 6 OPERATION

Index to Work Contents

How to use this chapter:

The index to items to be manipulated during operation is shown below.

Contents of Work	Reference Pages		
To indicate a PV	p.6-5	6-3	Indicating a PV
To indicate an SP	p.6-5	6-4	Indicating an SP
To indicate the output value	p.6-6	6-5	Indicating an Output Value
To indicate the motor valve opening	p.6-7	6-6	Displaying the Motor Valve Opening
To change an SP (with single SP)	p.6-8	6-7	Changing an SP
To select an SP (multi SP)	p.6-9	6-8	Selecting an SP and Changing Its Set Value
To change the set value of an event	p.6-10	6-9	Changing the Set Value of Event
To change the AUTO/MANUAL mode	p.6-12	6-10	How to Change the AUTO/MANUAL Mode
To change the RUN/READY mode	p.6-13	6-11	How to Change the RUN/READY Mode
To change the local SP (LSP)/remote SP (RSP) mode	p.6-14	6-12	How to Change the local SP (LSP)/remote SP (RSP) Mode
To start or stop auto-tuning	p.6-15	6-13	How to Start/Stop Auto-tuning

6-1 Turning on the Power Supply

! HANDLING PRECAUTIONS

This instrument is set not to function for up to seven seconds after the power is turned ON to allow it to stabilize. Though operation is possible after this seven seconds, allow at least one hour for the instrument to warm up so as to satisfy the specified accuracy.

6-2 Outline of Key Operations

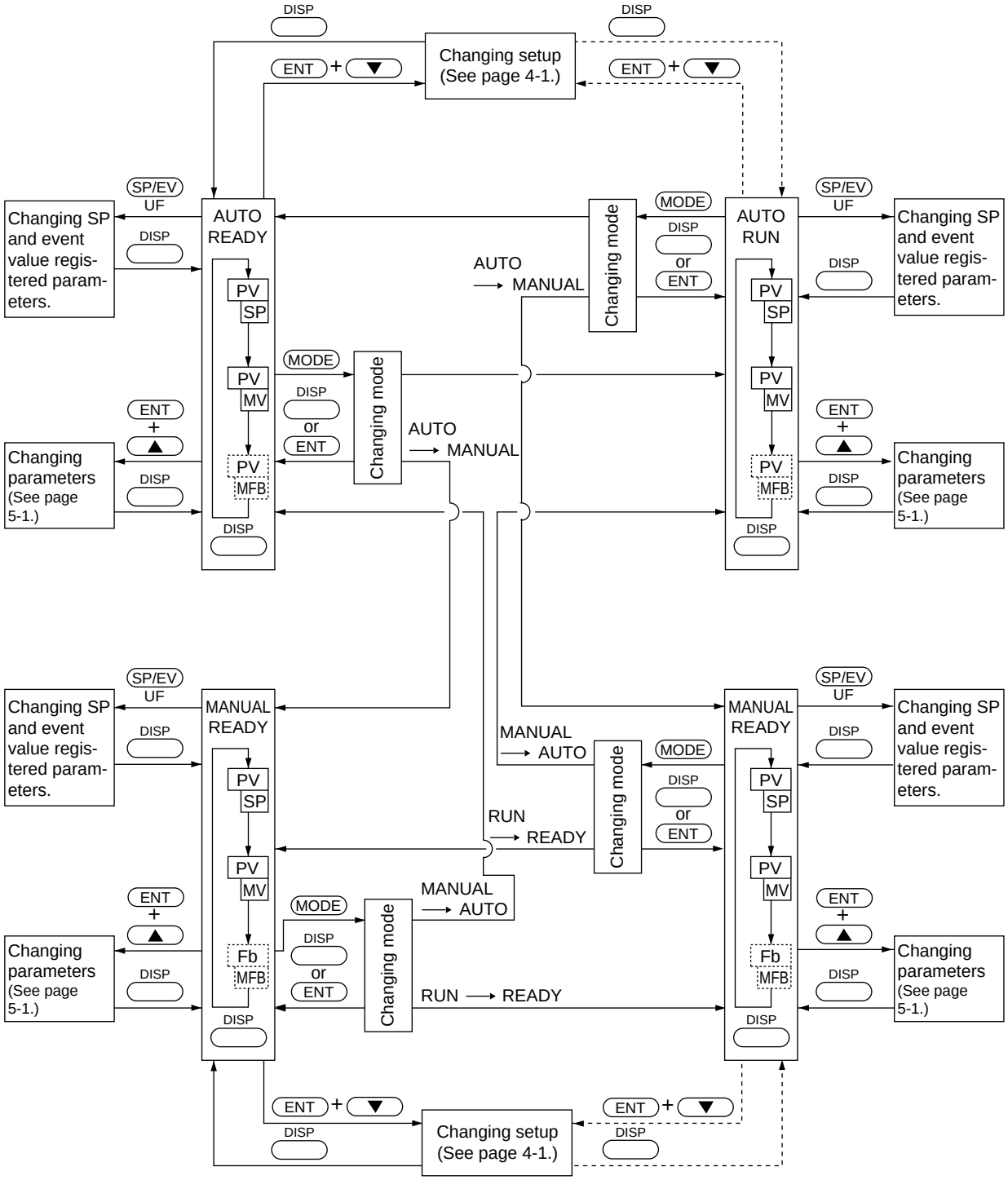
When the power is turned ON, the No.1 indicator indicates the PV value, and the No.2 indicator indicates the SP value (MV value in the MANUAL mode). This is called the "basic indication status." In this basic indication status, the SP value, MV value (only during position-proportional output) and motor valve opening can be displayed on the No.2 indicator by key operation.

Key operation also changes the status to the setting change status so that the SP value, event set value and assigned parameter set values can be changed.

Key operation also changes the status to the mode change status so that the AUTO/MANUAL, RUN/READY, LSP/RSP and auto-tuning stop/start mode can be changed.

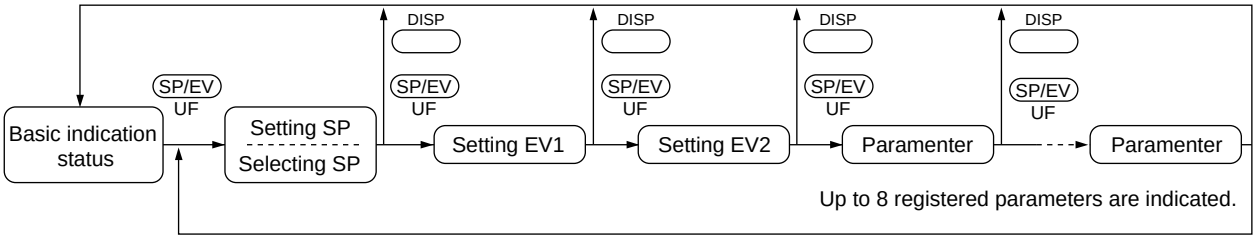
- In the RUN mode, setup items can be confirmed but their set values cannot be changed.

Key Operation Transition Modes

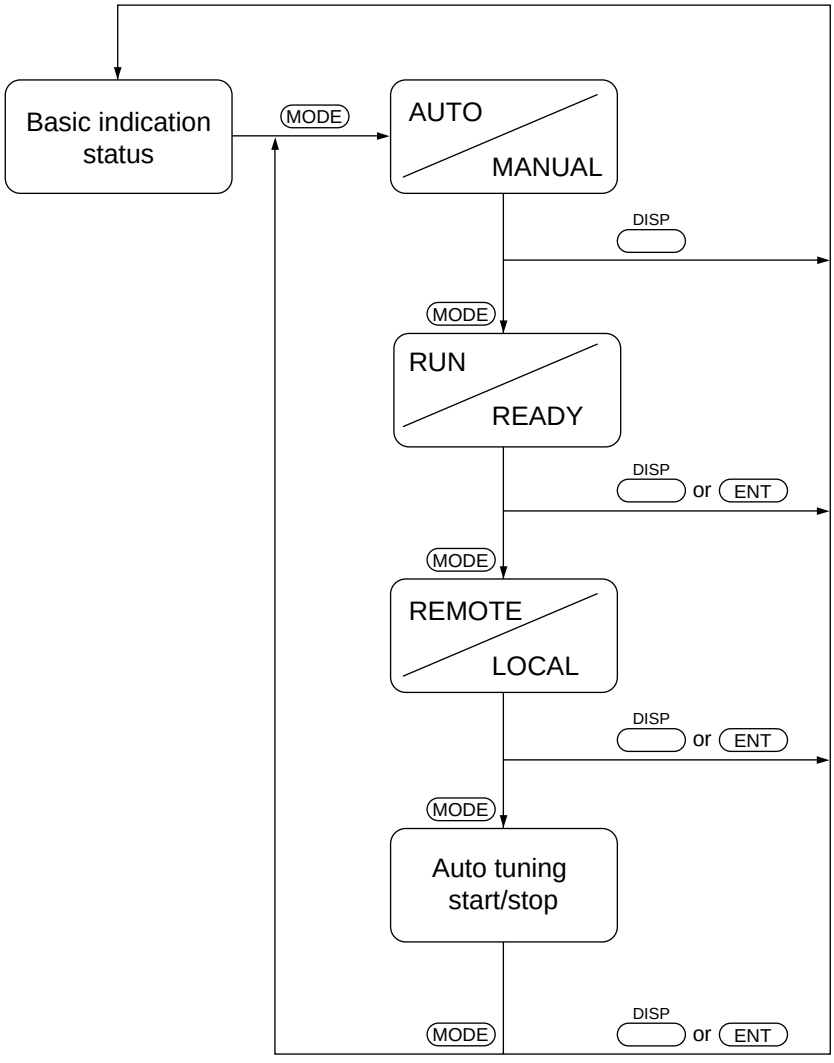


• In the RUN mode, setup items can be checked but neither set nor changed.

Flow of (SP/EV UF) Key Operation



Flow of (MODE) Key Operation



- Auto-tuning start/stop is not indicated in the MANUAL or READY modes.
- Functions assigned to external switch inputs are not indicated.

  When all functions have been assigned to external switch inputs, the display will remain in the basic indication status even if the (MODE) key is pressed.

6-3 Indicating a PV

The control value of temperature or pressure applied to this instrument is called a PV (Process Value).

When the instrument power supply is turned on, a PV is indicated in the No.1 indicator.

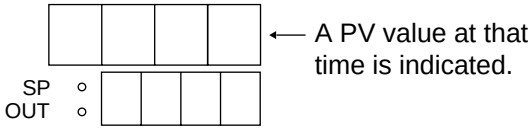
This status is called a basic indication status.

The contents of indication may be changed after operating any key.

To indicate a PV, press the DISP key, and a PV will be indicated in the No.1 indicator.

Operation Procedure

To indicate a PV — Press the DISP key.



← A PV value at that time is indicated.

Check item

If an alarm occurs, the alarm code and PV value are indicated alternately.

6-4 Indicating an SP

A desired value for controlling a PV is called an SP (Set Point).

When the instrument power supply is turned on, a PV is indicated in the No.1 indicator, and an SP in the No.2 indicator.

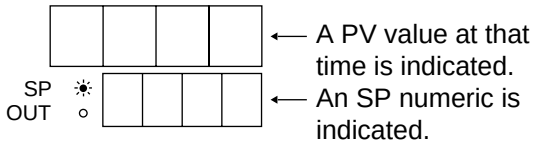
The contents of indication may be changed after pressing any key.

To indicate an SP, press the DISP key.

The SP LED lights and an SP is indicated in the No.2 indicator.

Operation Procedure

To indicate an SP — Press the DISP key.



← A PV value at that time is indicated.

← An SP numeric is indicated.

Note) Press the DISP key several times until the SP LED lights.

The SP LED lights.

6-5 Indicating the Output Value

The signal output from this controller is generally referred to as the MV, or manipulated variable.

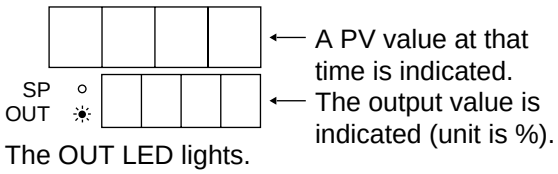
When the power is turned ON, the No.1 indicator indicates the PV value, and the No.2 indicator indicates the SP value. The contents of indication may be changed after operating any key.

To indicate an output value, press the DISP key several times. The OUT LED will light, and the output value will be indicated on the No.2 indicator.

Operation Procedure

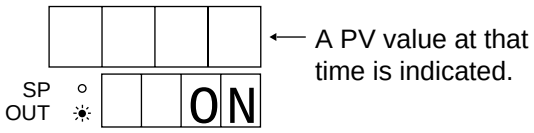
To indicate the output value

Press the DISP key. Press until OUT LED lights.

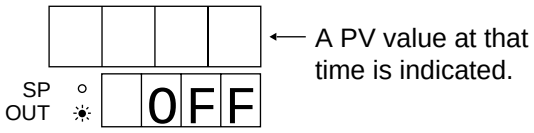


The OUT LED lights.

With ON-OFF control



or



6-6 Indicating the Motor Valve Opening (position-proportional output)

The motor valve opening can be indicated on 2G models (position-proportional output)

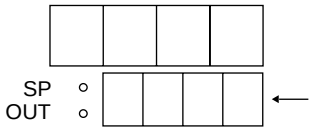
When the power is turned ON, the No.1 indicator indicates the PV value, and the No.2 indicator indicates the SP value. The contents of indication may be changed after operating any key.

To indicate the motor valve opening, press the DISP key several times. Both the OUT LED and SP LED will light, and the motor valve opening will be indicated on the No.2 indicator. However, the OUT LED will flash in the MANUAL mode.

Operation Procedure

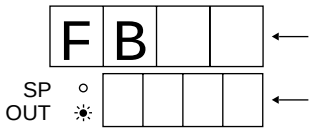
To indicate the motor valve opening

Press the DISP key.



← The motor valve opening is indicated (unit: %).
Both the SP and OUT LEDs go out.

In manual mode



← Fb is indicated.

← The OUT LED flashes.

Check items

Press the DISP key several times until both the OUT LED and SP LED both go out. However, the OUT LED will flash in the MANUAL mode.

The motor valve opening will be indicated flashing at 1-second cycles in the following instances:

① When inferred position control is selected by setup item C35 (modular control motor control selection

② When the internal inferred value is used due to a breakage in the feedback loop even though feedback ON control is selected

③ When the internal inferred value is used even though the motor backup function is selected

In these instances, too, position control will be continued using the internal inferred value.

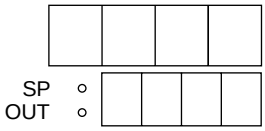
6-7 Changing an SP (with single SP)

To change an SP value of single SP, follow the operation procedure given below.

Operation Procedure The procedure for changing the SP from 500°C to 1000°C is shown below.

① To set to basic indication status

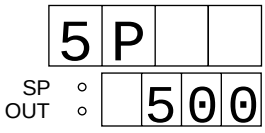
Press the DISP key.



← PV value or Fb at that time is indicated.
← SP value, MV value or motor valve opening is indicated.

② To indicate an SP

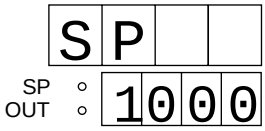
Press the SP/EV UF key.



← SP is indicated.
← The set value of that item flashes.

③ To change the set value

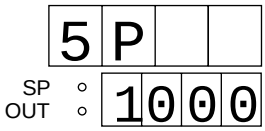
Change the numeric, using the ▲ or ▼ key.



← The changed numeric flashes.

④ To define the changed numeric

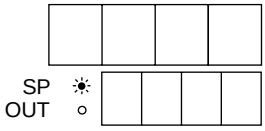
Press the ENT key.
→ Flashing stops and the set value is defined.



← Does not flash.

⑤ To reset to basic indication status

Press the DISP key.



← A PV numeric is indicated.
← An SP numeric is indicated.

6-8 Selecting an SP and Changing Its Set Value (with multi SP)

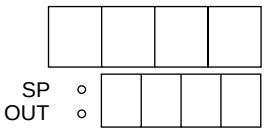
To change an SP value of multi SP, follow the operation procedure given below. With multi SP, there are eight set values SP0 and SP7.

Operation Procedure

In this example, SP1 is selected from a SP0 selected state. The procedure for changing the set value of SP1 from 300°C to 400°C.

① To set to the basic indication status

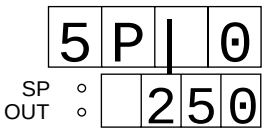
Press the DISP key.



← PV value or Fb at that time is indicated.
← SP value, MV value or motor valve opening is indicated.

② To indicate an SP

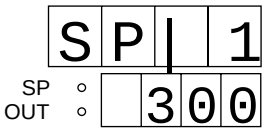
Press the SP/EV UF key. several times.



← SP0 is indicated.
← The SP setting is indicated.

③ To change the SP No.

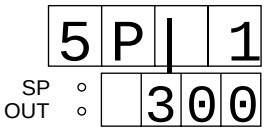
Change flashing indication 0 to 1 using the ▼ or ▲ key.



← Only 1 is flashing.
← The SP1 setting is indicated.

④ To define the changed SP

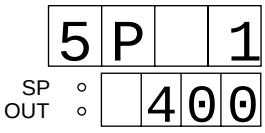
Press the ENT key.



← 1 stops flashing.
← The SP1 setting is flashing.

⑤ To change the setting of the selected SP No.

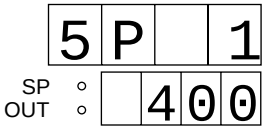
Press the SP/EV UF key, and change the setting using the ▲ or ▼ key. In this example, 300 is changed to 400.



← The changed numeric flashes.

⑥ To define the changed numeric

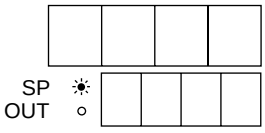
Press the ENT key.



← Does not flash.

⑦ To set to the basic indication status

Press the DISP key.



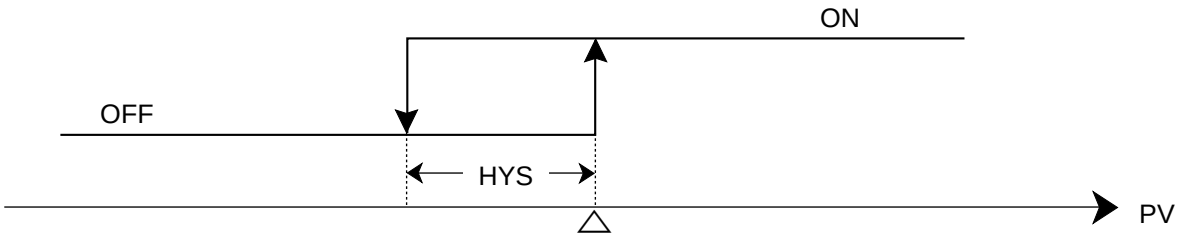
← A PV numeric is indicated.
← An SP numeric is indicated.

Check items

- For details on changing the set values of SP Nos. that are not selected in the case of multi SP, see Chapter 5.
- SP Nos. cannot be selected by the front panel keys when SP selection is being carried out by external switch input (when C26 is set to a value other than "0"). However, the set value of selected SP Nos. can be changed.

6-9 Changing the Set Value of Event

When the event output function is provided as an option, its set value (e.g. output at alarm position) can be changed. However, when the set value of setup item C21 or C23 (event action type) is 0, event action is turned off, and E1 and E2 are not indicated. E1 and E2 are also not indicated when the set value is 16, 17 or 18.



Event set value (EV)

In this example, the event output is turned on when the PV becomes higher than the event set value.

The event set value is turned off when the PV is lower than (event set value - differential).

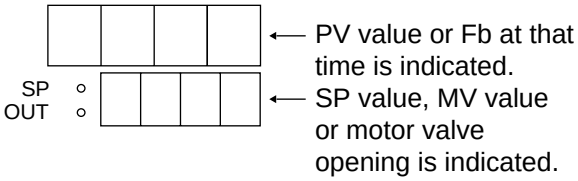
The procedure for changing the event set value is shown below as an example.

Operation Procedure

The procedure for changing the event 1 from 100°C to 200°C, and the event 2 from 700°C to 800°C is shown below as an example.

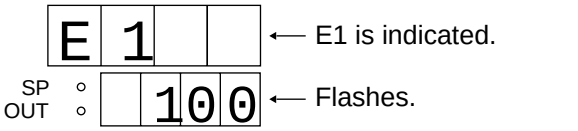
① To set to basic indication status

Press the DISP key.



② To indicate the event

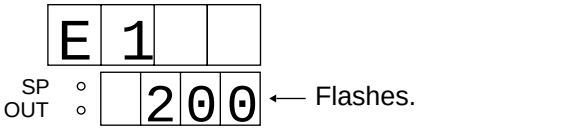
Press the SP/EV UF key twice.



Note) In the case of multi-SP, press 3 times.

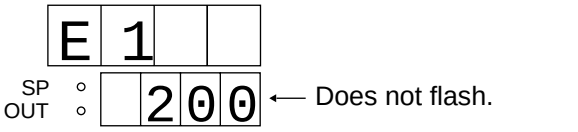
③ To change the set value

Press the ▲ key or ▼ key.
In this example, press the ▲ key to change 100 to 200.



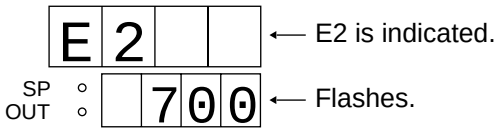
④ To define the changed numeric

Press the ENT key.



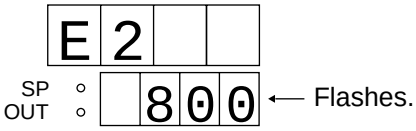
⑤ To indicate the event 2

Press the SP/EV UF key.



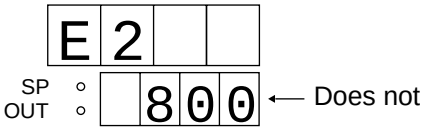
⑥ To change the set value

Press the ▲ key or ▼ key.
In this example, press the ▲ key to change 700 to 800.



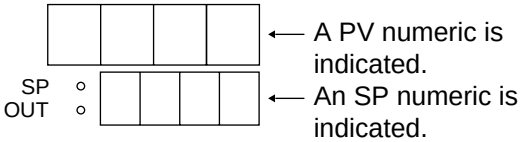
⑦ To define the changed numeric

Press the ENT key.



⑧ To reset to basic indication status

Press the DISP key.



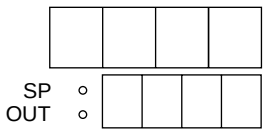
6-10 How to Change the AUTO/MANUAL Mode

This parameter allows you to set the AUTO mode when the results of PID operation are output, or the MANUAL mode on the front panel for setting the MV value.

Operation Procedure The procedure for changing the AUTO mode to the MANUAL mode is shown below.

① To set to the basic indication status

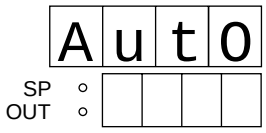
Press the DISP key.



← A PV value at that time is indicated.
← SP value, MV value or motor valve opening is indicated.

② To indicate the mode

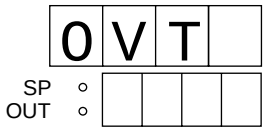
Press the MODE key.



← AUto is indicated flashing.
← Nothing is indicated.

③ To change the mode

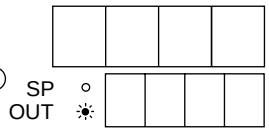
Display out using the ▲ or the ▼ key.



← out is indicated flashing.

④ To define the changed mode

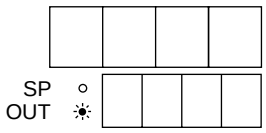
Press the ENT key.
→ The manual mode is entered once the ENT key is pressed, and the OUT LED starts to flash.



← A PV value at that time is indicated.
← The MV value is indicated flashing.

⑤ To change the MV value

Set the MV value to the desired value using the ▲ or the ▼ key.



← A PV value at that time is indicated.
← An SP value or MV value is indicated.

Check items

- When the power is turned on again in the MANUAL mode, the set value of setup item C14 will be output.
- When AUTO/MANUAL switching is set to the external switch input function, AUto or out will not be displayed even if the MODE key is pressed.

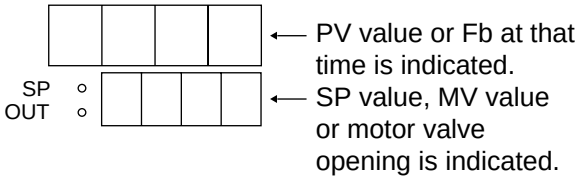
6-11 How to Change the RUN/READY Mode

This parameter allows you to select the READY mode in which PID operation is stopped and the RUN mode in which PID operation is executing.

Operation Procedure The procedure for changing the READY mode to the RUN mode is shown below.

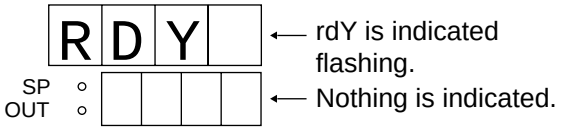
① To set to the basic indication status

Press the DISP key.



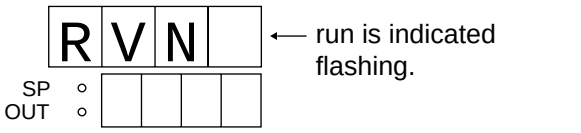
② To indicate the mode

Press the MODE key twice.



③ To change the mode

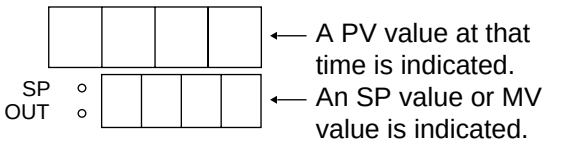
Display run using the ▲ or the ▼ key.



④ To define the changed mode

Press the ENT key.

➪ The mode is defined, and the indication returns to the Basic indication status.



Check items

- The green belt flashes in the READY mode.
- When RUN/READY switching is set to the external switch input function, "rdy" or "run" will not be displayed even if the MODE key is pressed.

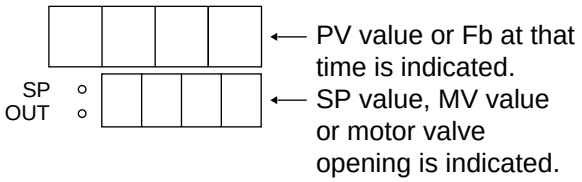
6-12 How to Change the local SP (LSP)/remote SP (RSP) Mode

On models provided with the remote setting input function, this parameter allows you to set the local SP (LSP) for setting the value set (selected) by the front panel keys on the instrument as the setpoint, or the remote SP (RSP) mode for setting the signal (4 to 20 mA or 1 to 5 V) from peripheral equipment as the setpoint.

Operation Procedure The procedure for changing the LSP mode to the RSP mode is shown below.

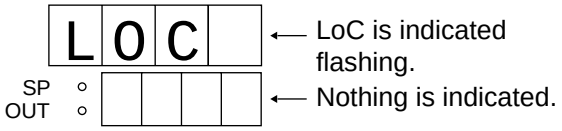
① To set to the basic indication status

Press the DISP key.



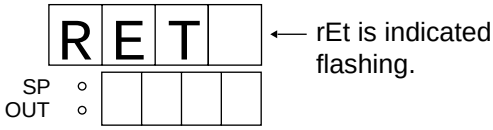
② To indicate the mode

Press the MODE key 3 times.



③ To change the mode

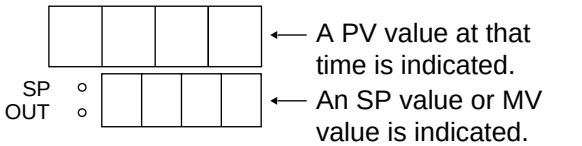
Display rEt using the ▲ or ▼ key.



④ To define the changed mode

➪ The mode is defined, and the indication returns to the Basic indication status.

Press the ENT key.



Check items

- When REMOTE/LOCAL switching is set to the external switch input function, LoC or rEt will not be displayed even if the MODE key is pressed.

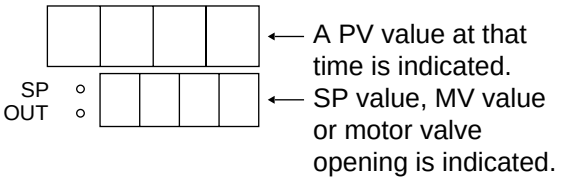
6-13 How to Start/Stop Auto-tuning

Auto-tuning can be stopped or started only in the AUTO or RUN modes.

Operation Procedure The procedure for starting auto-tuning is shown below.

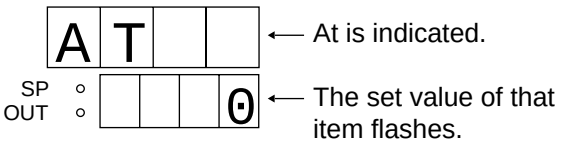
① To set to the basic indication status

Press the DISP key.



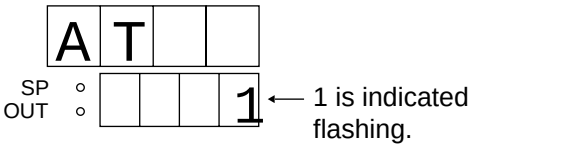
② To indicate At

Repeatedly press the MODE key several times until At is indicated, and press the ENT key.



③ To change the set value

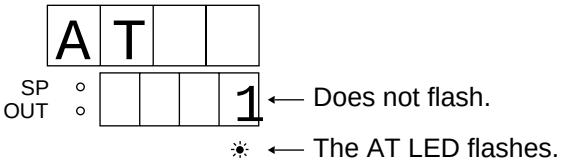
Press the ▲ key to change 0 to 1.



④ To define the changed numeric

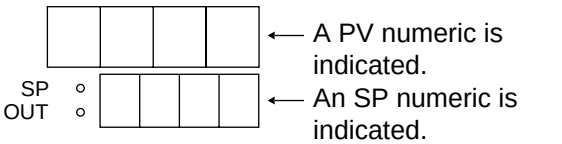
Press the ENT key.

→ Flashing stops and auto-tuning starts.



⑤ To set to the basic indication status

Press the DISP key.



➪ When auto-tuning ends, the AT LED goes out. The PID value found is written automatically in this instrument.

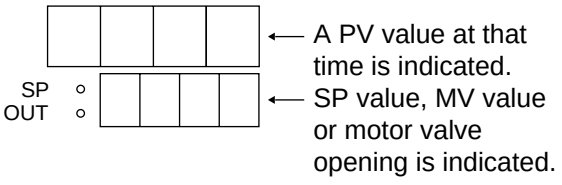
Check items

When start of auto-tuning is set to the external switch input function, **AT** will not be displayed even if the MODE key is pressed.

Operation Procedure The procedure for canceling auto-tuning when auto-tuning has been started is given below.

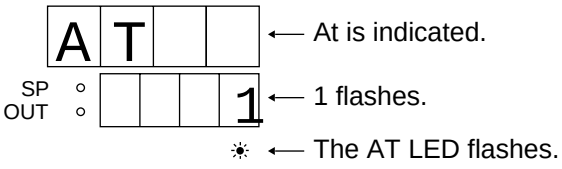
① To set to the basic indication status

Press the DISP key.



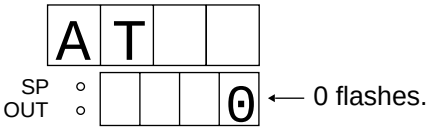
② To indicate At

Repeatedly press the MODE key several times until At is indicated, and press the ENT key.



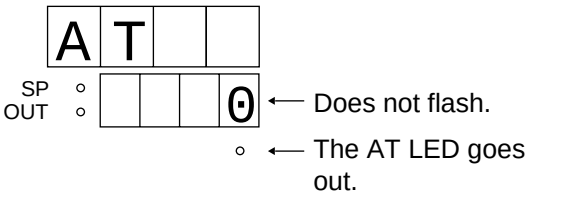
③ To change the set value

Press the ▼ key to change 1 to 0.



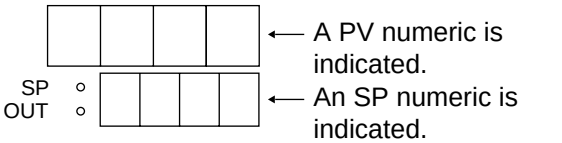
④ To define the changed numeric

Press the ENT key.
→ Flashing stops, and auto-tuning is interrupted.



⑤ To set to the basic indication status

Press the DISP key.



! HANDLING PRECAUTIONS

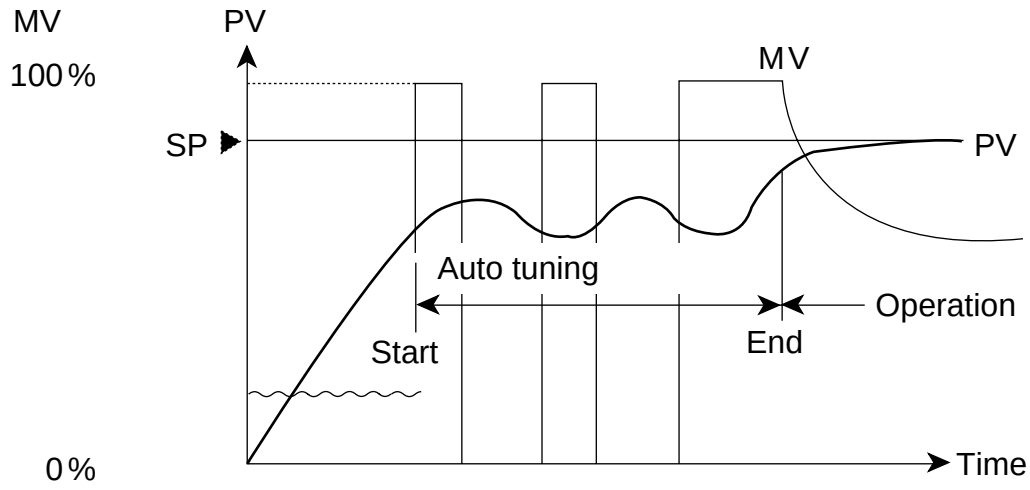
- Auto tuning does not function normally if it is not connected to a controlled system.
- Optimum PID values cannot always be obtained in certain controlled systems. In such a case, set the PID values manually.
- During auto tuning operation, hunting may occur in the controlled system. If hunting is not desirable, set PID values manually.
- The time required for tuning depends upon the control system.
- With multi SP, the values obtained by auto tuning are written to the PID group corresponding to the present set SP.
- Auto-tuning is canceled when a PV burnout (alarm code 01, 02), change from the RUN to the READY mode, change from the AUTO to the MANUAL mode, or a power interruption occurs during auto-tuning.
- The SP group cannot be changed during auto-tuning. However, the SP value can be changed.
- When the SP group has been changed by external switch input, the results of auto-tuning are written to the PID group linked with the SP group before the change, and the external switch input is switched to the specified SP group after auto-tuning ends.
- When auto-tuning is carried out when zone PID use is selected, the results will be written to the PID group of the zone to which the SP belongs after auto-tuning ends.
- When auto-tuning is executed during SP ramp, SP ramp continues to operate.

One Point Memo

Auto tuning is provided to automatically obtain optimum PID values (Proportional band) (Integral time) and (Derivative time) by measuring control systems.

This auto tuning can be operated during the steady-state operation as well as at start-up time.

For the PID values employed during the steady-state operation, it is recommended to obtain these values by operating the auto tuning at the same time (during steady-state operation).



Chapter 7 TROUBLESHOOTING

7-1 Alarms Indication

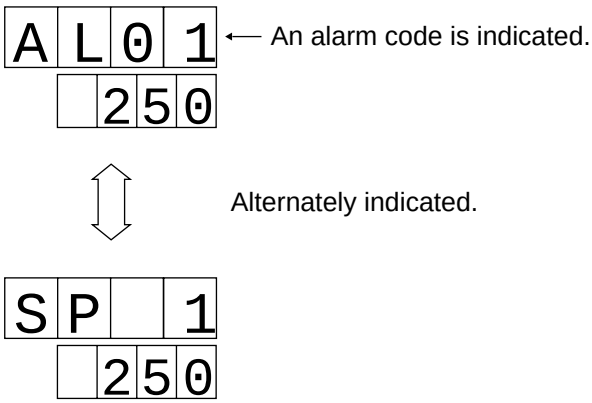
This instrument always executes PV input check, or self-diagnosis. If a problem is detected, the instruments indicates an alarm code on the No.1 indicator.

The No.1 indicator alternately indicates the display (such as PV) before the occurrence of the alarm and the alarm code.

! HANDLING PRECAUTIONS

No alarm code is indicated on the No.1 indicator during setup operation.

Example of indication:



7-2 Alarm Codes Table

Indication	Problem description	Measures
AL01	PV input exceeds +10% of the range (Over-range).	Check the sensor and wiring. Check the PV range.
AL02	PV input is less than -10% of the range (Under-range).	Check the sensor and wiring. Check the PV range.
AL03	C line input error during PTD input	Check C line wiring.
	CJ line input error during T/D input	Contact a YH service person for repair.
AL05	RSP over-range (displayed only during remote SP) (occurs at 110% of input range)	Check RSP wiring. Check RSP input value.
AL06	RSP under-range (displayed only during remote SP) (occurs at -10% of input range)	Check RSP wiring. Check RSP input value.
AL07	T line breakage, FB line input error (occurs only at C35=0,1)	Check FB wiring. Check FB input value.

Indication	Problem description	Measures
AL08	Motor adjustment error (fully closed adjustment value > fully open adjustment value)	M/M adjustment error • Check FB line, and re-adjust.
AL70	A/D converter error (pulse out signal error)	Ask for repair.
AL91	Illegal loader communication message	Check cable connections.
AL96	Parameter error (communication RAM area)	Reset parameter items.
AL97	Parameter error (checksum)	Reset parameter items.
AL98	Adjustment data error (checksum)	Ask for repair.

7-3 Other Troubles

When a key-in operation is not acceptable.

→ If a set value can be indicated but cannot be changed, the instrument is set to key lock status.

Set the setup item C01 “key lock” to 0.

When diFF (differential) cannot be set.

→ P is not 0.

The diFF can be set only when P=0.

When rE (manual reset) cannot be set.

→ I is not 0 and P is 0.

The rE can be set only when I=0, and P≠0.

At (auto-tuning) is not indicated.

→ The controller is in either the READY or MANUAL mode.

Auto-tuning can be started or stopped only in the AUTO or RUN modes.

Control is not output.

→ The controller is in either the READY or MANUAL mode.

PID operation is executed in the RUN mode, and the calculation results are taken as the MV value in the AUTO mode.

The output value is not indicated in the MANUAL mode.

→ The modular control motor control method is set to “no feedback” (C35=2).

In the no-feedback MANUAL mode, the open relay or the closed relay can only be set to ON.

Chapter 8 SPECIFICATIONS

8-1 Model Number Configuration

1 2 3 4 5 6 7 8 9 10 11 12

C 3 ∗ ∗ ∗ A 0 ∗ ∗ ∗ 0 0

I	II	III	IV	V

Example: C 3 0 2 G A 0 0 0 1 0 0

I	II	III	IV	V

No.	Model number		Contents
I	Basic model No.	C30 C31	Digital indicating controller, mask size 48 mm x 96 mm Digital indicating controller, mask size 96 mm x 96 mm
II	Output type control mode	0D 6D 5G 2G	Relay output, time proportional PID control/on-off control Voltage output, time proportional PID control/on-off control Current output, continuous PID control Relay output for modular control motor drive, position-proportional PID control
III	Power voltage	A0 AZ D0 DZ	85 to 264V ac, 50/60 Hz 85 to 264V ac, 50/60 Hz, apply to RT 50 21.6 to 26.4V dc 21.6 to 26.4V dc, apply to RT 50
IV	Option	001 to 507 001 to 546	See pages 8-2. In case of C30 In case of C31
V	Additional functions	00 D0 T0 K0 Z0 B0 L0 E0 G0 F0 Q0 P0 Y0	Standard product Inspection certificate provided Tropical treatment Anti-sulfidization treatment Correspondence to Zener barriers Tropical treatment + inspection certificate provided Anti-sulfidization treatment + inspection certificate provided Correspondence to Zener barriers + inspection certificate provided Tropical treatment + correspondence to Zener barriers Anti-sulfidization treatment + correspondence to Zener barriers Tropical treatment + correspondence to Zener barriers + inspection certificate provided Anti-sulfidization treatment + correspondence to Zener barriers + inspection certificate provided Complying with the traceability certification

• Options (Additional functions)

EV1: 1st event
EV2: 2nd event
AUX: Auxiliary output
RSPA: Remote setting input (4 to 20 mA)
RSPV: Remote setting input (1 to 5 V)
1SW: External switch input (1 input)
4SW: External switch input (4 inputs)
485: Communication (RS-485)
○: Function supported
—: Function not supported
: No relevant model No.

C30 (48 x 96)

	Additional functions								Remarks			
No.	EV1	EV2	AUX	RSPA	RSPV	1SW	4SW	485	0D	6D	5G	2G
001	○	○	—	—	—	—	—	—				
002	○	○	—	—	—	○	—	—				
003	○	○	—	—	—	—	○	—				
004	○	○	○	—	—	○	—	—				
040	—	—	—	—	—	—	—	○				
041	○	○	—	—	—	—	—	○				
402	○	○	—	○	—	○	—	—				
406	○	○	○	○	—	—	—	—				
407	○	—	—	○	—	—	—	—				
502	○	○	—	—	○	○	—	—				
506	○	○	○	—	○	—	—	—				
507	○	—	—	—	○	—	—	—				

C31 (96 x 96)

	Additional functions								Remarks			
No.	EV1	EV2	AUX	RSPA	RSPV	1SW	4SW	485	0D	6D	5G	2G
001	○	○	—	—	—	—	—	—				
003	○	○	—	—	—	—	○	—				
005	○	○	○	—	—	—	○	—				
045	○	○	○	—	—	—	○	○				
405	○	○	○	○	—	—	○	—				
446	○	○	○	○	—	—	—	○				
505	○	○	○	—	○	—	○	—				
546	○	○	○	—	○	—	—	○				

ATTACHMENTS

- Mounting bracket: 81405411-001 (1 set)
- Unit indicating label: N3132

OPTIONS

- Hard dustproof cover: 81446082-001 (for 48 x 96)

  81446083-001 (for 96 x 96)

  This hard dustproof cover is made of semi-transparent polycarbonate.

  The packing included in the package is affixed around the body of the panel on which the SDC30/31 is mounted. When this cover is mounted, the indication can be confirmed but not operated.

  This cover is constructed so that its hooks fit into the protrusions on the SDC30/31 case. When removing the cover, insert a Phillips screwdriver into the top or bottom groove, and lift up so that the hook comes away from the body.

- Soft dustproof cover: 81446086-001 (for 48 x 96)

  81446087-001 (for 96 x 96)

  This soft dustproof cover is made of transparent silicon rubber.

  Remove the keyboard cover on the body before use.

  The indicator can be confirmed and operated with this cover on the body.

- Terminal cover: 81446088-001 (for 48 x 96)

  81446084-001 (for 96 x 96)

  This cover is made of non-inflammable heat-resistant PVC sheet.

  The 48 x 96 cover can be attached without the aid of screws.

  To remove this cover, lift up the hook section with a Phillips screwdriver.

  The 96 x 96 cover can be attached with the screws provided in the package.

8-2 Specifications

PV Input

Type of input:	See the input range table on page 4-7.
Selection of the input type:	Any type can be selected. (full multi-range)
°C °F selection:	With T/C and RTD.
Range setting:	Range can be set by contracting it to 1/4 of the original range width.
	Programmable range, with linear input (Possible by scaling).
Setting of decimal point:	With the linear input, decimals can be freely set.
	With temperature inputs, setting is possible in certain ranges, to one decimal point. (See the input range table on page 4-7)
Input sampling cycle:	200 ms.
Indicating accuracy:	±0.2% FS ±1 digit (Specified by input conversion under standard conditions.) The accuracy of B thermocouples is not specified lower than 260°C (500°F).
	±0.3% FS +1 digit for 0 to 10 mV input

T/C input (under operating conditions)

Input bias current: 0.16 μA (Flows from + terminal.)

Input circuit failure indication: Upscale + AL01

RTD input (under operating conditions)

Input bias current: 1 mA (Flows from terminal A.)

Input circuit failure indication:

When the resistor or A line is broken ..... Upscale + AL01

When B line is broken ..... Down scale + AL02, 03

When C line is broken ..... Undefined indication + AL03

When A and B lines are broken ..... Upscale + AL01, 03

When B and C lines are broken ..... Upscale + AL01, 03

When A and C lines are broken ..... Upscale + AL01, 03

When A, B, and C lines are broken .... Upscale + AL01, 03

Linear voltage input (under operating conditions)

Input bias current: 0.6 μA (Flows into + terminal.)

Input circuit failure indication: Down scale + AL02

Linear current input (under operating conditions)

Receiving resistance:	100 Ω
Input circuit failure indication:	Down scale + AL02 (A 0 to 20 mA input circuit failure is not detectable.)
Max. input current/voltage:	Max. input current 24 mA dc Max. input voltage 2.4V dc Normal operation will no longer be possible if these values are exceeded.
Absolute max. input ratings:	Current: 50 mA dc Voltage: 5V dc The “absolute max. ratings” are current and voltage ratings that can be applied to input terminals without any deterioration in characteristics or mechanical breakdown. Note that these are not ranges of assured controller operation.

Remote switch input (RSW) (under operating conditions)

No. of channels:	1 or 4
Input type:	No-voltage contact or open collector
Off- terminal voltage:	5 ±1 V
Turn-on current:	5 ±2 mA (A current flowing to the contact)
Allowable contact resistance:	ON Lower than 100 Ω OFF Upper than 100 kΩ
Allowable residual voltage at open collector ON:	1.2 V max.
Allowable leakage current at open collector OFF:	0.2 mA max.
Minimum hold time:	400 ms

Control output

Relay output (0D)

Control action:	Time proportional PID, PD + MR, or on-off.
Output type:	SPDT relay output
Relay contact rating:	250V ac, 30V dc, 5 A (Resistive load)
Electrical life of relays:	More than 100,000 times
Minimum on-off time:	Longer than 250 ms

Voltage output (6D)

Control action:	Time proportional PID, PD + MR, or on-off
Output voltage (open time):	22.5V dc ±15% (under operating conditions)
Internal resistance:	1.1 kΩ ±10%

Current output (5G)

Control action:	Current proportional PID or PD + MR
Output type:	4 to 20 mA dc current output
Allowable load resistance:	750 Ω max. (under operating conditions)
Output accuracy:	±0.2% FS max. (under standard conditions)
Output current range:	2.4 mA to 21.6 mA
Output update cycle:	200 ms
Output response time:	170 ms max. (90% response)
Voltage at terminal open:	26V dc max.

Motor drive output (2G)

Control action:	Position-proportional PID, PD+MR
Output type:	(SPST relay output) x 2
Relay contact rating:	250V ac, 8 A (resistance load)
Electrical life of relays:	More than 100,000 times

Event output (EV 1 to 2)

No. of channels:	0 to 2 (Depends upon models.)
Output type:	SPST relay output
Relay contact rating:	250V ac, 30V dc, 5 A
Output update cycle:	200 ms
Electrical life of relays:	More than 100,000 times

Auxiliary output (AUX)

Output type:	4 to 20 mA dc current output
Output contents:	PV, SP, RSP, RSP (pre-biased), MV, motor valve opening
Allowable load resistance:	750 Ω max. (under operating conditions)
Output accuracy:	±0.2%FS max. (under standard conditions)
Output resolution:	0.01%FS
Voltage at terminal open:	26V dc max.

RSP input (option)

Input type:	Linear 4 to 20 mA, or linear 1 to 5 V
Scaling:	Possible within range -1999 to +9999. Any decimal point position can be set
Input sampling cycle:	200 ms

Readout accuracy (instrument nominal): ±0.2 FS ± 1U (under standard conditions)

Voltage input specifications (under operating conditions)

Input resistance:	1 to 5 V input; 1 MΩ min.

Input bias voltage: 1 to 5 V input; 5 μA max. (drawn in to + terminal)

Influence of wiring resistance: 1 to 5 V input; -5 μV/Ω max.

Over-range alarm: AL05

Under-range alarm: AL06

Operation at input breakdown: Downscale + AL06

Current input specifications (under operating conditions)

Reception resistance: 100 Ω

Over-range alarm: AL05

Under-range alarm: AL06

Operation at input breakdown: Downscale + AL06

Communications (RS-485)

Transmission format: Balanced

Transmission channel: 5 leads*

Transmission speed: 9600, 4800, 2400, 1200 bps

Transmission distance: 500 m max.*

Communication method: Half-duplex

Synchronizing system: Asynchronous

Communication code: 8 bits, 1 stop bit, even parity

8 bits, 2 stop bits, no parity

Communication address : 0 to 127 (0: no response)

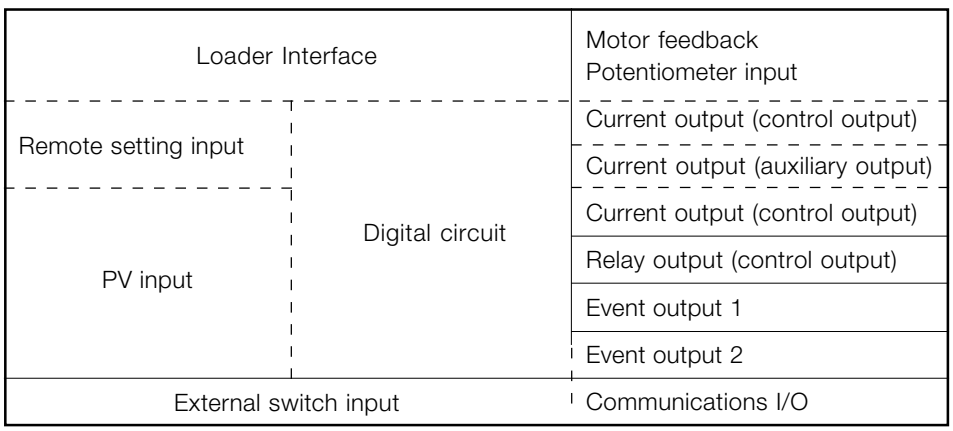
Error detection: Parity check, checksum

Connection mode: 1:N (max. 31 units)

* When the CMC410 or DIM are used as the host station, the transmission channel is 3 leads, the transmission distance is 300 m maximum, and the maximum number of controllers that can be connected is 16.

Input-output isolation

The isolation between input and output signals is illustrated below. Those bounded by a solid line are isolated from others. These bounded by a dotted line are not isolated.



Environmental conditions

Standard conditions

Ambient temperature:	23 ±2°C
Ambient humidity:	60 ±5%RH
Power voltage (AC models):	105V ac ±1%
Power frequency (AC models):	50/60 Hz ±1 Hz
Power voltage (DC models):	24V dc ±5%
Vibration resistance:	0 m/s^2
Shock resistance:	0 m/s^2
Mounting angle:	(Reference level) ±3°

Operating conditions

Ambient temperature:	0 to 50°C
Ambient humidity:	10 to 90%RH
Power voltage (AC models):	85 to 264V ac
Power frequency (AC models):	50/60 ±2 Hz
Power voltage (DC models):	21.6 to 26.4V dc
Vibration resistance:	2 m/s^2
	(10 to 60 Hz, in X, Y, Z directions for 2 hours each)
Shock resistance:	0 to 9.8 m/s^2
Mounting angle:	(Reference level) ±10°

Transportation and storage conditions

Ambient temperature:	-20 to +70°C
Ambient humidity:	10 to 95%RH
Vibration resistance:	0 to 4.9 m/s^2
	(10 to 60 Hz, in X, Y, Z directions for 2 hours each)
Shock resistance:	0 to 490 m/s^2 (3 times in vertical direction, when packaged.)
Package drop test:	Drop height 60 cm (Free drop from one corner, 3 edges, and 6 faces)

Other specifications

Rated power voltage (AC models):	100 to 240V ac, 50/60 Hz
Rated power voltage (DC models):	24V dc
Power interruption dead time:	20 ms min. (under operating conditions)
Insulation resistance:	50 MΩ min. between case or GND terminal and power terminals using a 500V dc megger
Dielectric strength (AC models):	1500 V, 1 minute between case or GND terminal and power terminals

Dielectric strength (DC models):	500 V, 1 minute between case or GND terminal and power terminals
Power consumption (AC models):	18V A max. (at operating conditions)
Power consumption (DC models):	7.5 W max. (at operating conditions)
Weight:	SDC30 Approx. 400 g, SDC31 Approx. 500 g
Mounting:	Panel-mount
Terminal screw:	M3.5 self-up screw
Terminal screw tightening torque:	0.78 to 0.98 N•m{8 to 10 kgf•cm}
Attachment:	Mounting fixture set, product manual, industrial unit seal
Mask color:	Dark gray
Case color:	Light gray
Mounting:	Permanent connection type unit, indoor mounting, panel mounting
Applicable standards:	EN61010-1, EN50081-2, EN50082-2, EN61326
Installation category:	II (IEC664-1, EN61010-1)
Pollution degree:	2

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Chapter 9 MAINTENANCE

Cleaning: Clean the instrument with a soft, dry cloth when it becomes dirty.

Replacing Parts: Only authorized personnel are allowed to replace parts.

Replacing Fuses: In case of AC power supply models, when replacing fuses provided on the power supply circuit, use only standard parts specified below.

Standard	IEC127
Type	Time-lag (T)
Voltage rating	250 V
Current rating	0.5 A

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APPENDICES

SDC 30/31 Setting Work Sheets

Description of Terms and Abbreviations

SDC30/31 Setting Work Sheets

Customer's Name

Instrument Supervisor

Model No.

C	3										

Sales Agent

Tag Name

Date

Day/Month/Year

1. Setup

Indication Factory setting	Setup item	Setting by user
C 01 0	Key lock 0: No key lock 1: This setting (C01), settings relating to SP/EV/UF keys and mode can be changed. 2: 1 above excluding event setting can be changed. 3: Only this setting (C01) can be changed.	C 01
C 02 0	Temperature unit 0: °C 1: °F	C 02
C 03 0	Control action 0: Reverse action 1: Direct action	C 03
C 04 0	PV input range 1 to 18: Thermocouple input 20, 21, 30, 31: Platinum resistance thermometer 40, 41, 45, 46, 50 to 52: Linear input	C 04
C 05 0	Decimal point position 0: With no decimal point Example: 1000 1: 1 decimal digit is indicated Example: 100.0 2: 2 decimal digits are indicated Example: 10.00 3: 3 decimal digits are indicated Example: 1.000	C 05
C 06 0	Lower-limit of PV input range (selected range lower-limit) to (PV upper-limit) * In case of linear input, can be set from -1999.	C 06
C 07 0	Upper-limit of PV input range (PV lower-limit) to (selected range upper-limit) * In case of linear input, can be set to 9999.	C 07

Indication Factory setting	Setup item	Setting by user
C08 0	SP setting system 0: Single SP 1: 2 SPs (SP0, SP1) 2: 3 SPs (SP0 to SP2) 3: 4 SPs (SP0 to SP3) 4: 5 SPs (SP0 to SP4) 5: 6 SPs (SP0 to SP5) 6: 7 SPs (SP0 to SP6) 7: 8 SPs (SP0 to SP7)	C08
C09 0	Lower-limit of SP (PV lower-limit) to (SP limit upper-limit)	C09
C10 1000	Upper-limit of SP (SP lower-limit) to (PV upper-limit)	C10
C11 0	Selection of output in case of PV abnormal 0: Output PID calculation results. 1: Output C12 setting. Closed relay ON (in case of 2G model, C35=2) 2: Open relay ON (in case of 2G model, C35=2)	C11
C12 0	Control output at READY and PV abnormal 0 to 100% (0D, 6D, 2G) -10 to +110% (5G)	C12
C13 0	Manual initial control output selection 0: Bump-less 1: Preset	C13
C14 0	Preset manual value 0 to 100% (0D, 6D, 2G) -10 to +110% (5G)	C14
C15 0	Initial manipulated variable in PID operation 0 to 100%	C15
C16 0	PID operation initialize 0: AUTO 1: Initialize at SP (set) change or RSP/LSP switching 2: Do not initialize	C16
C17 0	Zone PID operation 0: OFF 1: ON	C17
C18 0	Control system selection 0: Normal PID control 1: Overshoot relaxation 2: Learning function status 3: Fixed learning status	C18
C19 0	Independent 2-degrees of freedom PID operation selection 0: Not used 1: Used	C19
C20 0	Neural network auto-tuning operation selection 0: Used 1: Not used	C20

Indication Factory setting	Setup item	Setting by user
C 21 0	Event 1 type 0: Event OFF 1: Deviation (direct action) 2: Deviation (reverse action) 3: PV (direct action) 4: PV (reverse action) 5: Absolute value deviation (direct action) 6: Absolute value deviation (reverse action) 7: SP (direct action) 8: SP (reverse action) 9: MV (direct action) 10: MV (reverse action) 11: Motor feedback (direct action) 12: Motor feedback (reverse action) 13: Control loop diagnosis 14: Timer (sec.) 15: Timer (min) 16: Alarm (direct action) 17: Alarm (reverse action) 18: Execution at inferred position	C 21
C 22 0	Event 1 standby operation selection 0: Standby OFF 1: Standby ON	C 22
C 23 0	Event 2 type Same as event 1	C 23
C 24 0	Event 2 standby operation selection Same as event 1	C 24
C 25 0	Event operation at READY 0: ON 1: OFF	C 25
C 26 0	Number of SPs selectable by external switch input 0: SP not selectable 2: Two SPs (SP0, SP1) selectable by RSW1 4: Four SPs (SP0 to SP3) selectable by RSW1 and RSW2 8: Eight SPs (SP0 to SP7) selectable by RSW1, RSW2 and RSW3	C 26
C 27 0	External switch input 1 function 0: No operation 1: RUN/READY 2: AUTO/MANUAL 3: LSP/RSP 4: STOP/START (auto-tuning) 5: PID direct/reverse (reverse of C03 setting when RSW is ON) 6: Reset/start (timer EV1) 7: Reset/start (timer EV2) * (state when OFF)/(state when ON)	C 27
C 28 0	External switch input 2 function Same as external switch input 1 function	C 28
C 29 0	External switch input 3 function Same as external switch input 1 function	C 29
C 30 0	External switch input 4 function Same as external switch input 1 function	C 30
C 31 0	Communication address 0 to 127	C 31
C 32 0	Transmission speed 0: 9600 bps 2: 2400 bps 1: 4800 bps 3: 1200 bps	C 32

Indication Factory setting	Setup item	Setting by user
C 33 0	Communication code 0: 8 bits, even parity, 1 stop bit 1: 8 bits, no parity, 2 stop bits	C 33
C 34 0	Dead zone 0.5 to 25.0%	C 34
C 35 0	Modular control motor control method selection 0: MFB+inference 1: MFB 2: Inference	C 35
C 36 0	Modular control motor start of automatic adjustment 0: Non-adjusted state 1: Adjustment executed	C 36
C 37 1000	Modular control motor fully closed adjusted value 0 to 9999	C 37
C 38 3000	Modular control motor fully open adjusted value 0 to 9999	C 38
C 39 30	Modular control motor fully open/closed time 5 to 240 s	C 39
C 40 0	SP ramp up gradient 0 to 9999 unit (0.1 unit)/min (h)	C 40
C 41 0	SP ramp down gradient 0 to 9999 unit (0.1 unit)/min (h)	C 41
C 42 0	SP ramp time unit selection 0: Unit/min 1: 0.1 unit/min 2: Unit/h 3: 0.1 unit/h	C 42
C 43 5	Green belt 0 to 1/2 PV range	C 43
C 44 0	Auxiliary output type 0: PV 1: SP 2: Pre-bias RSP 3: RSP 4: MV 5: Motor valve opening	C 44
C 45 0 or 0.0	Value of signal source at 4 mA auxiliary output -1999 to +9999 unit (C04=0, 1, 2, 3) -199.9 to +999.9% (C04=4, 5)	C 45
C 46 1000 or 100.0	Value of signal source at 20 mA auxiliary output -1999 to +9999 unit (C04=0, 1, 2, 3) -199.9 to +999.9% (C04=4, 5)	C 46

Indication Factory setting	Setup item	Setting by user
C47 0	RSP value at 0% input -1999 to +9999 unit	C47
C48 1000	RSP value at 100% input -1999 to +9999 unit	C48
C49 0	Cold junction compensation operation selection 0: ON 1: OFF	C49
C50 0	Zener barrier adjustment -20.00 to +20.00	C50
C51 0	Adjustment code Do not change this factory setting.	C51 0

2. Parameter

Indication Factory setting	Setup item	Setting by user
Bank: SP		
SP 0 0	SP0 setting (SP lower-limit) to (SP upper-limit)	SP 0
SP 1 0	SP1 setting (SP lower-limit) to (SP upper-limit)	SP 1
SP 2 0	SP2 setting (SP lower-limit) to (SP upper-limit)	SP 2
SP 3 0	SP3 setting (SP lower-limit) to (SP upper-limit)	SP 3
SP 4 0	SP4 setting (SP lower-limit) to (SP upper-limit)	SP 4
SP 5 0	SP5 setting (SP lower-limit) to (SP upper-limit)	SP 5
SP 6 0	SP6 setting (SP lower-limit) to (SP upper-limit)	SP 6
SP 7 0	SP7 setting (SP lower-limit) to (SP upper-limit)	SP 7
Bank: PIdO		
P 5.0	Proportional band 0 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	P
I 120	Integral time 0 0 to 3600 s	I
d 30	Derivative rate 0 0 to 1200 s	d
oL 0	MV lower-limit 0 0 to (MV upper-limit value) %	oL
oH 100	MV upper limit 0 (MV lower-limit value) to 100%	oH

Indication Factory setting	Setup item	Setting by user
Bank: P1 d1		
P 1 5.0	Proportional band 1 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	P 1
I 1 120	Integral time 1 0 to 3600 s	I 1
d 1 30	Derivative rate 1 0 to 1200 s	d 1
oL 1 0	MV lower-limit 1 0 to (MV upper-limit value) %	oL 1
oH 1 100	MV upper limit 1 (MV lower-limit value) to 100%	oH 1
Bank: P1 d2		
P 2 5.0	Proportional band 2 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	P 2
I 2 120	Integral time 2 0 to 3600 s	I 2
d 2 30	Derivative rate 2 0 to 1200 s	d 2
oL 2 0	MV lower-limit 2 0 to (MV upper-limit value) %	oL 2
oH 2 100	MV upper limit 2 (MV lower-limit value) to 100%	oH 2
Bank: P1 d3		
P 3 5.0	Proportional band 3 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	P 3
I 3 120	Integral time 3 0 to 3600 s	I 3
d 3 30	Derivative rate 3 0 to 1200 s	d 3
oL 3 0	MV lower-limit 3 0 to (MV upper-limit value) %	oL 3
oH 3 100	MV upper limit 3 (MV lower-limit value) to 100%	oH 3

Indication Factory setting	Setup item	Setting by user
Bank: PId4		
P 4 5.0	Proportional band 4 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	P 4
I 4 120	Integral time 4 0 to 3600 s	I 4
d 4 120	Derivative rate 4 0 to 1200 s	d 4
oL 4 0	MV lower-limit 4 0 to (MV upper-limit value) %	oL 4
oH 4 100	MV upper limit 4 (MV lower-limit value) to 100%	oH 4
Bank: PId5		
P 5 5.0	Proportional band 5 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	P 5
I 5 120	Integral time 5 0 to 3600 s	I 5
d 5 30	Derivative rate 5 0 to 1200 s	d 5
oL 5 0	MV lower-limit 5 0 to (MV upper-limit value) %	oL 5
oH 5 100	MV upper limit 5 (MV lower-limit value) to 100%	oH 5
Bank: PId6		
P 6 5.0	Proportional band 6 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	P 6
I 6 120	Integral time 6 0 to 3600 s	I 6
d 6 30	Derivative rate 6 0 to 1200 s	d 6
oL 6 0	MV lower-limit 6 0 to (MV upper-limit value) %	oL 6
oH 6 100	MV upper limit 6 (MV lower-limit value) to 100%	oH 6

Indication Factory setting	Setup item	Setting by user
Bank: PId7		
P 7 5.0	Proportional band 7 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	P 7
I 7 120	Integral time 7 0 to 3600 s	I 7
d 7 120	Derivative rate 7 0 to 1200 s	d 7
oL 7 0	MV lower-limit 7 0 to (MV upper-limit value) %	oL 7
oH 7 100	MV upper limit 7 (MV lower-limit value) to 100%	oH 7
Bank: PIdr		
P r 5.0	Proportional band r (RSP) 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	P r
I r 30	Integral time r (RSP) 0 to 3600 s	I r
d r 120	Derivative rate r (RSP) 0 to 1200 s	d r
oL r 0	MV lower-limit r (RSP) 0 to (MV upper-limit value) %	oL r
oH r 100	MV upper limit r (MV lower-limit value) to 100%	oH r
Bank: PI50		
dP 0 5.0	Proportional band for inhibiting external disturbance 0 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	dP 0
dI 0 120	Integral time for inhibiting external disturbance 0 0 to 3600 s	dI 0
dd 0 30	Derivative time for inhibiting external disturbance 0 0 to 1200 s	dd 0

Indication Factory setting	Setup item	Setting by user
Bank: P1 S1		
dP 1 5.0	Proportional band for inhibiting external disturbance 1 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	dP 1
dI 1 120	Integral time for inhibiting external disturbance 1 0 to 3600 s	dI 1
dd 1 30	Derivative time for inhibiting external disturbance 1 0 to 1200 s	dd 1
Bank: P1 S2		
dP 2 5.0	Proportional band for inhibiting external disturbance 2 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	dP 2
dI 2 120	Integral time for inhibiting external disturbance 2 0 to 3600 s	dI 2
dd 2 30	Derivative time for inhibiting external disturbance 2 0 to 1200 s	dd 2
Bank: P1 S3		
dP 3 5.0	Proportional band for inhibiting external disturbance 3 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	dP 3
dI 3 120	Integral time for inhibiting external disturbance 3 0 to 3600 s	dI 3
dd 3 30	Derivative time for inhibiting external disturbance 3 0 to 1200 s	dd 3
Bank: P1 S4		
dP 4 5.0	Proportional band for inhibiting external disturbance 4 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	dP 4
dI 4 120	Integral time for inhibiting external disturbance 4 0 to 3600 s	dI 4
dd 4 30	Derivative time for inhibiting external disturbance 4 0 to 1200 s	dd 4

Indication Factory setting	Setup item	Setting by user
Bank: P155		
dP 5 5.0	Proportional band for inhibiting external disturbance 5 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	dP 5
dI 5 120	Integral time for inhibiting external disturbance 5 0 to 3600 s	dI 5
dd 5 30	Derivative time for inhibiting external disturbance 5 0 to 1200 s	dd 5
Bank: P156		
dP 6 5.0	Proportional band for inhibiting external disturbance 6 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	dP 6
dI 6 120	Integral time for inhibiting external disturbance 6 0 to 3600 s	dI 6
dd 6 30	Derivative time for inhibiting external disturbance 6 0 to 1200 s	dd 6
Bank: P157		
dP 7 5.0	Proportional band for inhibiting external disturbance 7 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	dP 7
dI 7 120	Integral time for inhibiting external disturbance 7 0 to 3600 s	dI 7
dd 7 30	Derivative time for inhibiting external disturbance 7 0 to 1200 s	dd 7
Bank: dISr		
dP r 5.0	Proportional band for inhibiting external disturbance r (RSP) 0.0 to 999.9% (0D, 6D) 0.1 to 999.9% (5G, 2G)	dP r
dI r 120	Integral time for inhibiting external disturbance r (RSP) 0 to 3600 s	dI r
dd r 30	Derivative time for inhibiting external disturbance r (RSP) 0 to 1200 s	dd r

Indication Factory setting	Setup item	Setting by user
Bank: PArA		
HYS1 5	EV1 hysteresis 0 to 100 U	HYS1
dL 1 0	EV1 ON delay time 0 to 9999 s	dL 1
HYS2 5	EV2 hysteresis 0 to 100 unit	HYS2
dL 2 0	EV2 ON delay time 0 to 9999 s	dL 2
FILt 0.0	PV filter 0.0 to 120.0 s	FILt
PbiA 0	PV bias -1000 to +1000 unit	PbiA
rbiA 0	RSP bias -1999 to +9999 unit	rbiA
CYCL 10	Time-proportional output cycle time 5 to 120 s (0D) 1 to 120 s (6D)	CYCL
outL 100.0	MV rate-of-change limit 0.0 to 100.0%	outL
Bank: ZonE		
Zn 1 100.0	Zone 1 0.0 to 100.0%	Zn 1
Zn 2 100.0	Zone 2 0.0 to 100.0%	Zn 2
Zn 3 100.0	Zone 3 0.0 to 100.0%	Zn 3
Zn 4 100.0	Zone 4 0.0 to 100.0%	Zn 4
Zn 5 100.0	Zone 5 0.0 to 100.0%	Zn 5
Zn 6 100.0	Zone 6 0.0 to 100.0%	Zn 6
Zn 7 100.0	Zone 7 0.0 to 100.0%	Zn 7

3. SP/EV/UF

Indication Factory setting	Setup item	Setting by user
SP 0	SP value * Single SP [C08=0] (SP lower-limit) to (SP upper-limit)	SP
SP 0 0	SP set * Multi-SP [C08=1 to 7] 0 to (C08 setting)	SP 0
SP 0 0	SP value of selected SP set * Multi-SP [C08=1 to 7] (SP lower-limit) to (SP upper-limit)	SP 0
E1 0	Event output 1 setting - (PV range span)/2 to (PV range span)/2 : Deviation (PV range lower-limit) to (PV range upper-limit) : PV 0 to (PV range span)/2 : Absolute value deviation (SP lower-limit) to (SP (upper-limit) : SP -10.0 to +110.0% : MV (5G) 0.0 to 100.0% : MV (0D, 6D, 2G) 0.0 to 100.0% : Motor valve opening 0.0 to 100.0% : Control loop diagnosis 1 to 9999 : Timer (sec., min) Setting not possible : Alarm, execution at inferred position	E1
E2 0	Event output 2 setting * See “Event output 1 setting” above.	E2

Description on Terms and Abbreviations

AT: Auto tuning. The numerics of PID are automatically adjusted optimum values.

DISP: Display. The indicated contents of the indicators are changed by pressing the DISP key.

OL: Output Low. Lower input of output. A minimum limit value of output is set.

OH: Output High. Upper limit of output. A maximum limit value of output is set.

PARA: Parameter. Variable which determines the operating conditions of this instrument.

PID: P (Proportioning) .... Proportional action

I (Integral) ..... Integral action or reset action

D (Derivative) ..... Derivative action or rate action

PV: Process variable. Measured value of thermocouple, resistance thermometer bulb, or linear input, etc.

MV: Manipulated Variable. This variable is the output of the instrument that is to be controlled, and indicates the output state during ON/OFF control.

SP: Set Point. This is the set point when controlling set values, for example, the temperature.

Setup: To set the operating conditions of this instrument such as an input range or control action according to how to use an associated equipment.

Differential: Differential gap in ON/OFF control action.

A differential value between control output on point and OFF point.

This prevents the control output from turning ON/OFF on a short cycle when a PV becomes equal to an SP.

Hysteresis: This refers to the differential during event action, or more specifically to the difference between the value by which the event status changes from OFF to ON, and the value by which the event status changes from ON to OFF.

This is indicated as "←HYS→" in figures in this manual.

EV: Event EV indicates the set value of the event function. The "event function " is the ON-OFF signal function that is output depending on the control status.

EV followed by a number (e.g. EV1, EV2) indicates the corresponding event No. for the event function.

U: Unit. This indicates the minimum digit of the selected PV input range.

For example, the minimum digit when K0.0 to 800.0 is selected is 0.1°C.

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Specifications are subject to change without notice.

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